Heating Piping & Air Conditioning

MAY
1959

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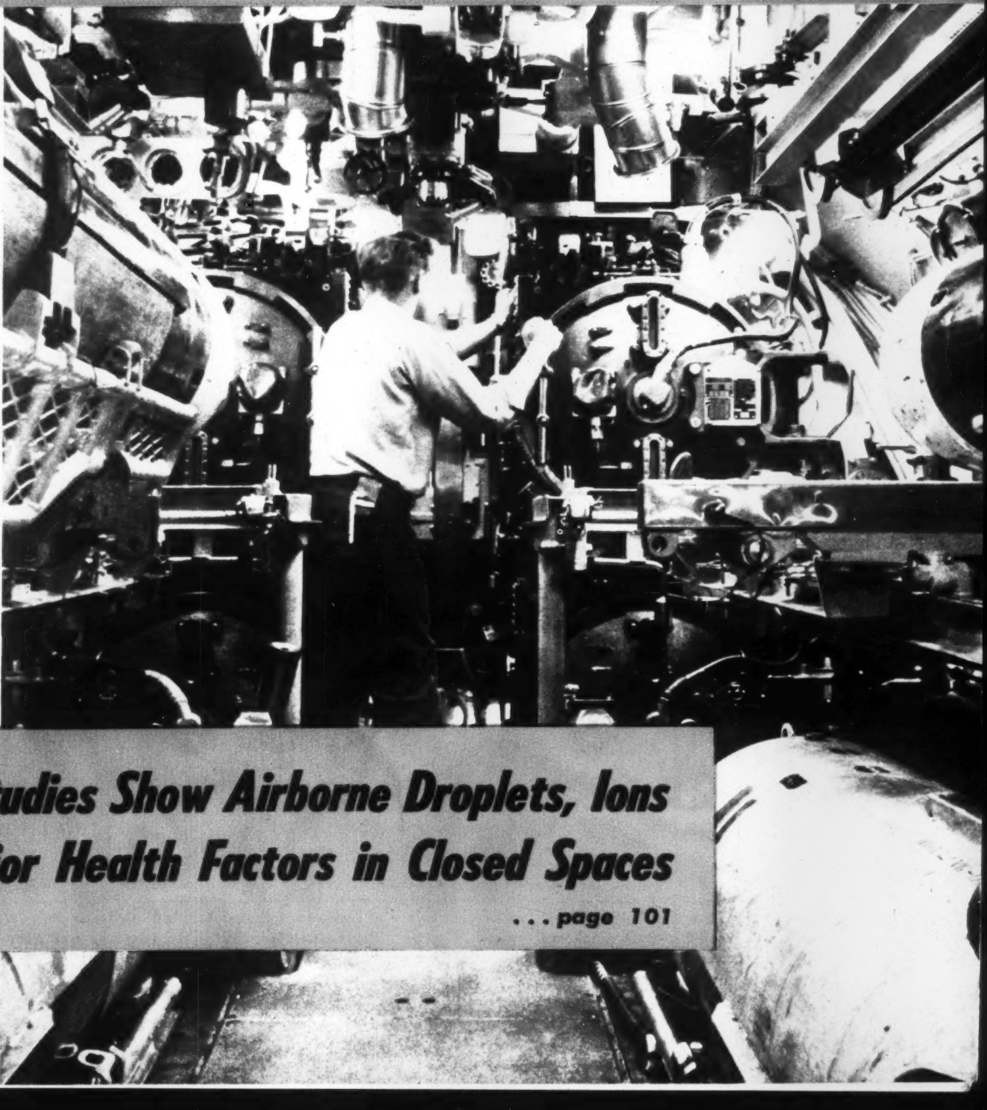

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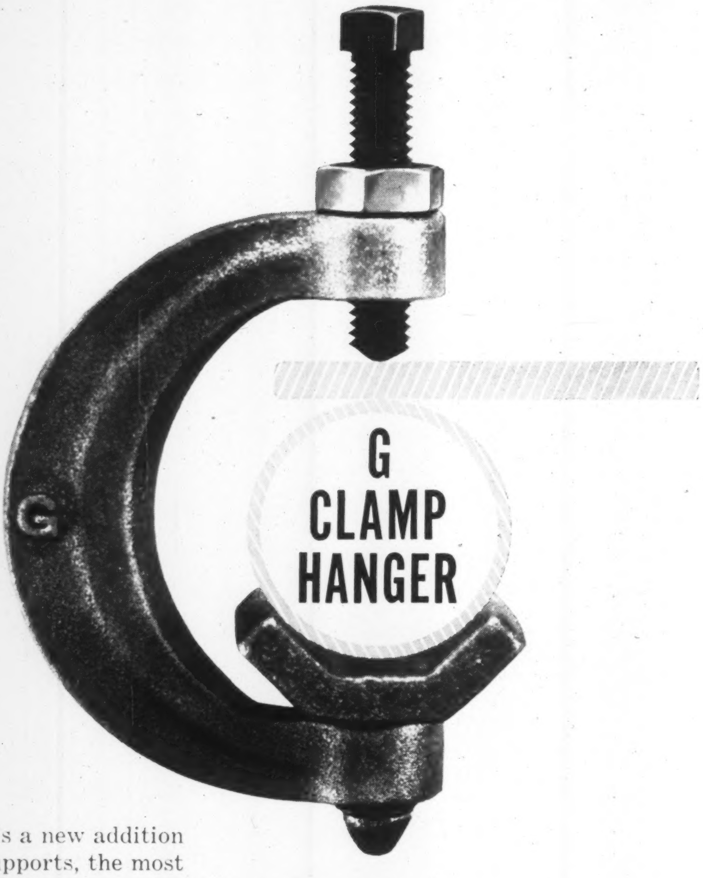
Single copy price 75c

New addition to the line of Grinnell malleable iron hangers



Grinnell's Malleable Iron G Clamp Hanger is a new addition to the line of Grinnell Pipe Hangers and Supports, the most complete line of any manufacturer. This hanger answers a long-felt need for support of pipe or conduit (up to 4 inches in size) where application can be made directly under structural steel.

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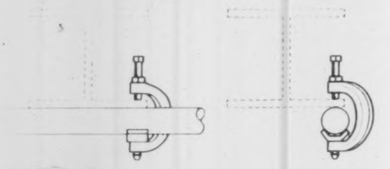

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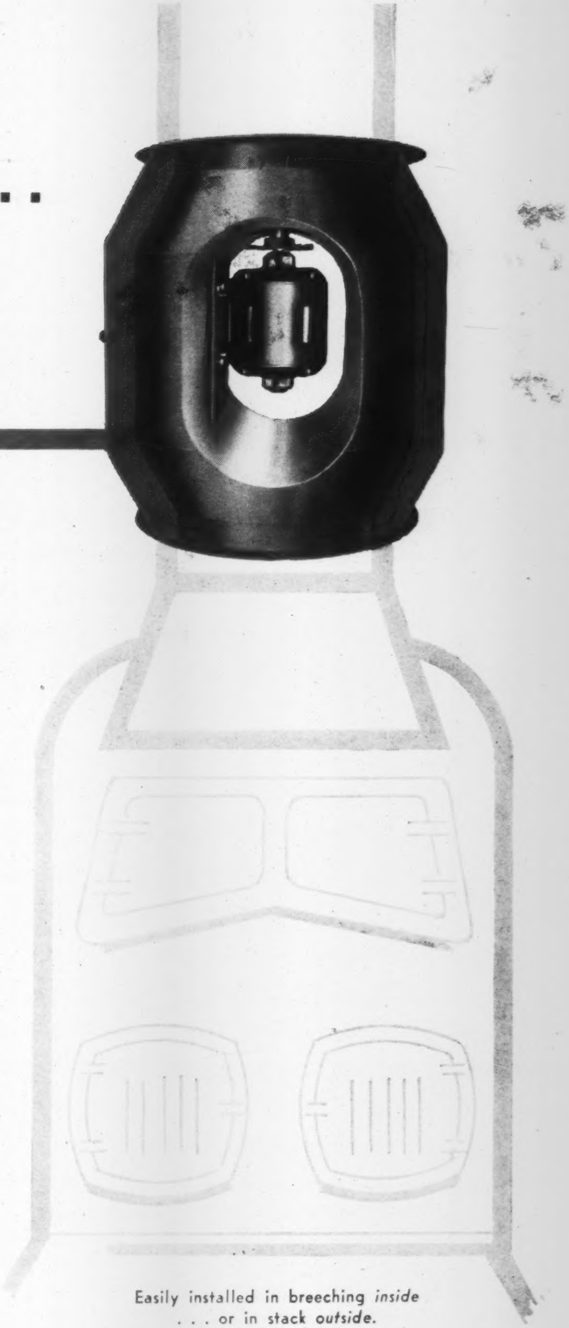

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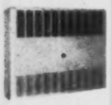

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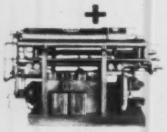

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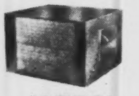

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Vol. 31, No. 5

(With which is merged the Aerologist)

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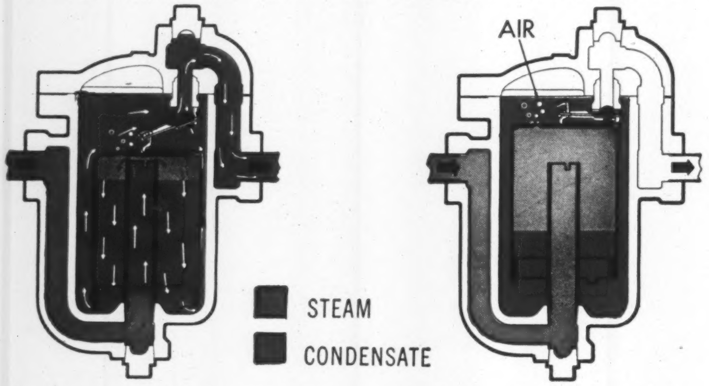
How Much Steam Should a Steam Trap Trap?

. . . some answers to commonly asked questions about the primary job of a steam trap

HERE'S THE STEAM TRAP DESIGN THAT GETS RID OF CONDENSATE AND AIR WITHOUT STEAM LOSS



Trap open. Condensate entering trap has caused bucket to lose buoyancy. Weight of bucket times leverage pulls valve open. Air is discharged along with condensate.

Trap closed. Steam has floated inverted bucket; valve is held tightly closed by system pressure. Air entering trap passes through bucket vent and accumulates at top of trap.

You don't need a doctor's degree in thermodynamics to answer the question at the top of this page. Naturally, a steam trap should trap *all* the steam.

Unfortunately for you, the problem isn't quite that simple. After all, a shut off valve would trap all the steam . . . and condensate, and air, and carbon dioxide as well.

So we'd better amend the answer to the question this way: A steam trap should trap *all* the steam but *must* remove condensate, air and carbon dioxide as rapidly as they accumulate.

With this established, let's take a closer look at what's involved:

A Steam Trap Should Trap All The Steam

If you've had experience with several different makes of traps, you already know that some trap steam better than others. The operating principle of the trap is what makes the difference. We like to talk about it because Armstrong traps are designed so that no steam can get to the orifice. The valve is always water sealed. Result: *More efficient steam utilization, lower fuel costs.*

A Steam Trap Should Remove Condensate

All traps remove condensate—after a fashion. For maximum efficiency in the unit being drained, though, the trick is to get it out without waiting for it to cool and without leaking steam.

Armstrong's water sealed valve takes care of steam leakage. The inverted bucket operating principle opens the trap for water regardless of its temperature. This means you get the condensate out as quickly as it accumulates. Result: *Higher temperatures and better heat transfer in steam heated units.*

A Steam Trap Should Remove Air and CO_2

Part and parcel of the condensate removal problem is removal of air as well as oxygen and carbon dioxide—two real troublemakers. Air tends to reduce operating temperatures and interfere with heat transfer. CO_2 goes into solution to form corrosive carbonic acid which, for example, can eat unit heater tubes. O_2 aggravates the situation. Believe it or not, but all traps don't properly remove air and CO_2.

By now, you've probably guessed that Armstrong traps *do* remove air and CO_2. Armstrong design (see illustration) provides continuous venting of air and CO_2. By opening suddenly, the Armstrong trap creates a momentary pressure drop to "pump" the air down to be vented. Result: *Higher temperatures, faster heat-up, better heat transfer and reduced corrosion.*

Note: When required, specially sized air vents are furnished. For fast heat-up of low pressure on-and-off units, Armstrong provides open float and thermostatic air vent traps.

What's the Final Answer?

Summing it all up, you'll get the best service from steam heated units that are equipped with traps designed to trap *all* the steam and remove air and condensate as quickly as it accumulates. In our prejudiced viewpoint, this means Armstrong traps. More important are the several thousand users of Armstrong traps who have proved the point.

Before you make up your mind, though, consider the minimum maintenance requirements of Armstrong traps . . . and the convenient assistance your local Armstrong Representative provides. These are important plus values.

Put Up or Shut Up

We're so confident that we "put up". Armstrong traps are unconditionally guaranteed to satisfy. So you can find out for yourself with practically no risk. If you're not completely satisfied with the way they do their job, you can get your money back.

* * *

The 44-page Armstrong Steam Trap book goes into greater detail on these and other Armstrong features. It also discusses trap selection, installation and maintenance. Ask your Armstrong Representative for a copy or write

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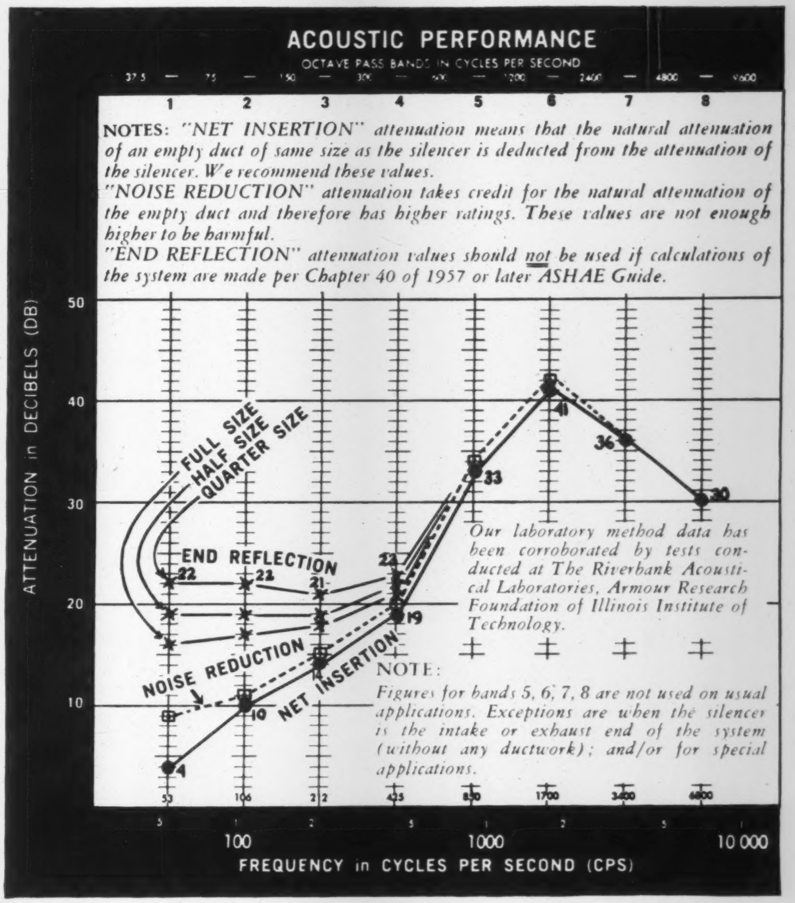

NOTES: *"NET INSERTION" attenuation means that the natural attenuation of an empty duct of same size as the silencer is deducted from the attenuation of the silencer. We recommend these values.*

"NOISE REDUCTION" attenuation takes credit for the natural attenuation of the empty duct and therefore has higher ratings. These values are not enough higher to be harmful.

"END REFLECTION" attenuation values should not be used if calculations of the system are made per Chapter 40 of 1957 or later ASHAE Guide.

Our laboratory method data has been corroborated by tests conducted at The Riverbank Acoustical Laboratories, Armour Research Foundation of Illinois Institute of Technology.

NOTE:

Figures for bands 5, 6, 7, 8 are not used on usual applications. Exceptions are when the silencer is the intake or exhaust end of the system (without any ductwork); and/or for special applications.

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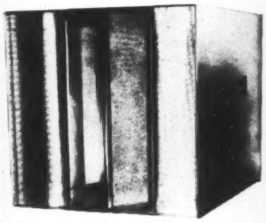

FULL SIZE
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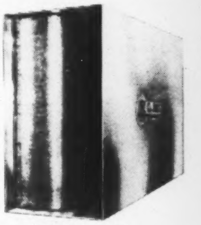

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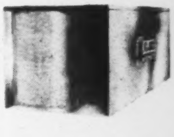

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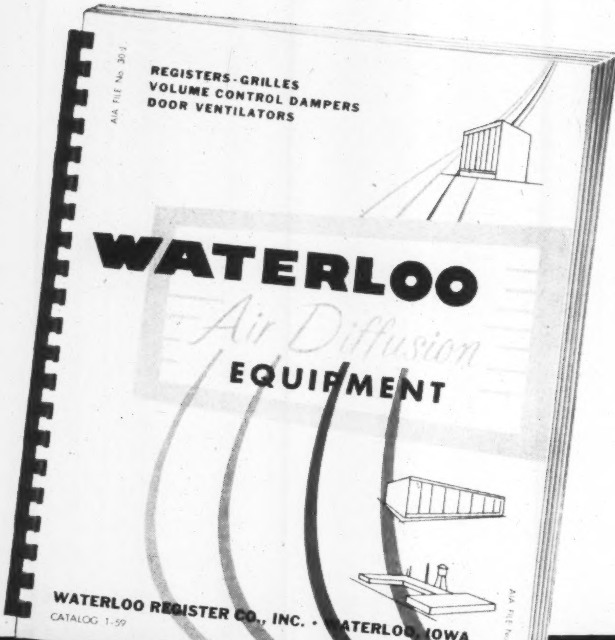
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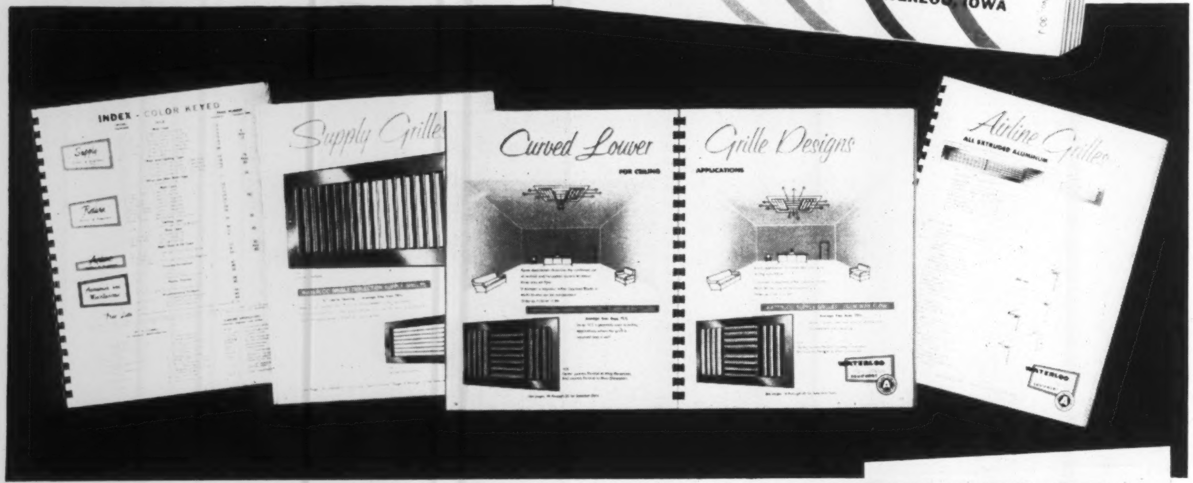
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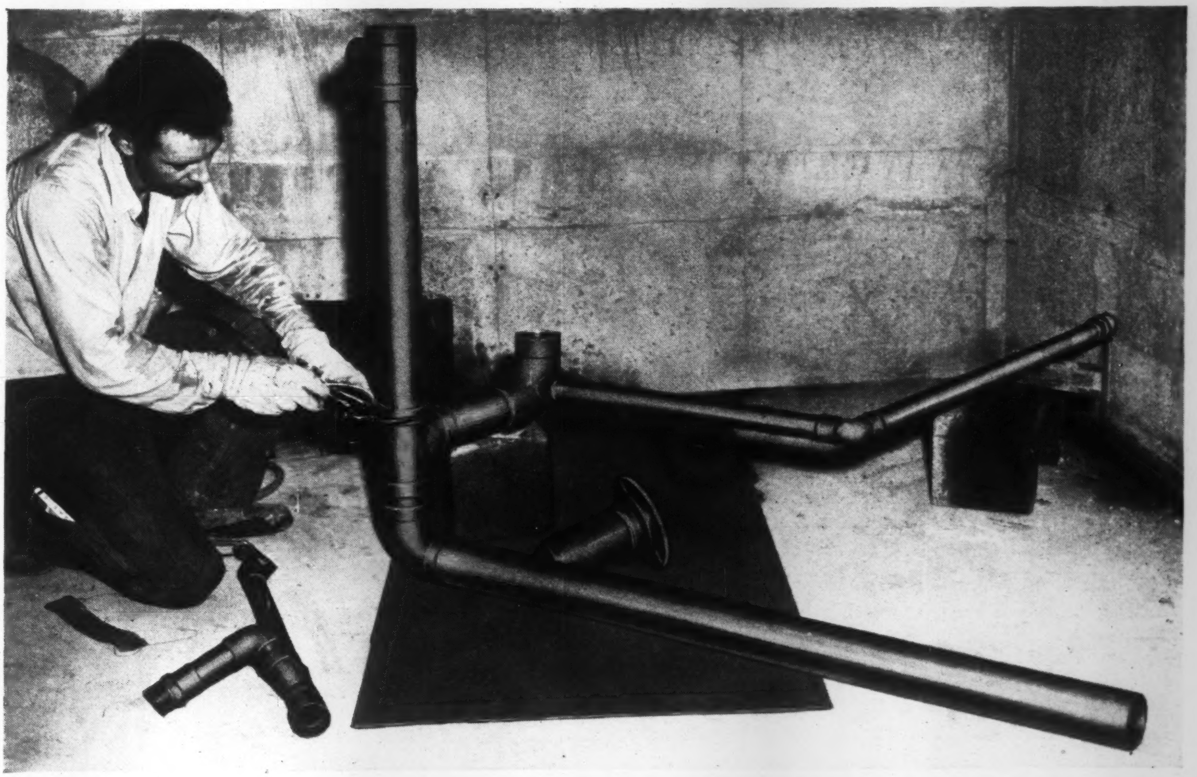

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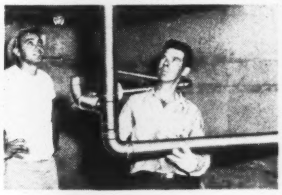

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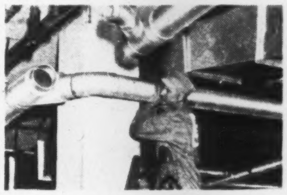


Compact Connections—Save Space

facts about Superior Packaged Boilers

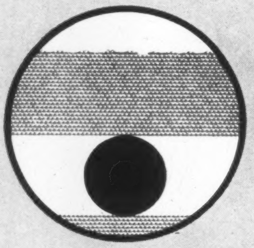
SUPERIOR'S MID-SHELL FURNACE LOCATION

protects against the two most common causes of furnace failure

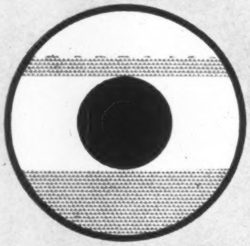
One of the often overlooked, and yet very important considerations for the purchaser or specifier of boilers of the horizontal fire-tube type is the location of the furnace in relation to the boiler shell. To a great extent this location is determined by whether the boiler is of the up-draft or down-draft type. Up-draft units usually have the furnace set low inside the shell. Down-draft units usually have a higher furnace location.

Ideally the furnace is located near the center of the shell, where it is protected from the two most common dangers which can cause bagging, blistering or complete burnout of the furnace.

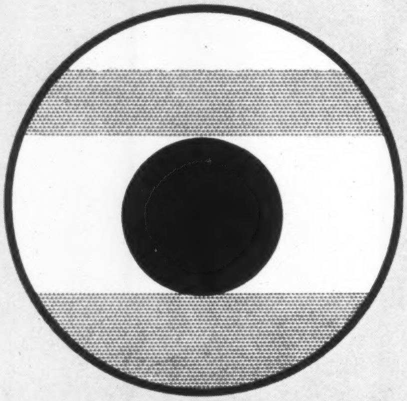
The first of these dangers is low-water. When the furnace is located too high in the shell, the covering layer of water is necessarily less, and the danger is increased. When the furnace is too low within the shell, mud and silt can deposit on the bottom of the shell and eventually bridge to the bottom of the furnace, cutting off circulation and causing a burnout of the furnace. The adjacent diagrams show the location of the furnace in other fire-tube boilers and in Superior Type C boilers. When you buy or specify a packaged fire-tube boiler consider this important fact.



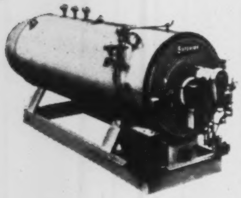
LOW FURNACE...MUD BURNOUT DANGER



HIGH FURNACE...LOW WATER BURNOUT DANGER



MID-SHELL LOCATION GUARDS AGAINST BOTH



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LETTER FROM THE EDITOR

May 1959

Dear Reader:

Airborne condensation droplets and ions may have major physiological significance on personnel housed in closed spaces for extended periods of time, according to Karl E. Schaefer in his article beginning on page 101. Dr. Schaefer reports on detailed studies of condensation droplet and ionization patterns made aboard German submarines during World War II. The data shows that the concentration of droplets and ions increased appreciably during submergence. This is the first time that this material has been made available in the U.S. Also cited are many references on the subject of the physiological effects of ions. Of course the information given in this article would apply to any occupied closed structure which is equipped with ion generating equipment.

Before designing a hot water heating system, careful consideration should be given to the range of temperatures which will be used in operation. G. F. Carlson outlines the fundamental factors for low, intermediate, and high temperature hot water heating systems, beginning on page 106. He shows how the temperature drop has a definite bearing on the selection of the most economical design for each application. He also explains how an increased temperature drop can decrease the pipe size and how the control of the systems becomes more critical as the temperature is increased.

Recent interpretations of the Code for Pressure Piping are presented on page 110. Since the Code was last issued in 1955, the sectional committee has been asked to interpret various statements contained therein. Among the subjects covered in the "cases" presented this month are stainless steel piping materials for nuclear energy installations, tensile strengths of piping materials for various applications, safety of piping materials used when short-time variations of pressure and temperature are encountered, and if reinforced concrete pipe can be used for certain applications under Section 1 of the Code.

The relative speed and weight of refrigeration compressors is an interesting subject which Lester T. Avery discusses this month in his article, "What Price Speed?" on page 113. He points out that we've come a long way in the last 25 to 30 years when considering that today's compressors weigh only one-tenth of those of equal capacity in the early 1930's. And of course for this reduction in weight, the speed has increased from five to 10 times. He points out, however, that under present-day high-speed conditions lubrication problems can be serious. Also, the dynamic balance of these high-speed compressors and their automatic control are vital to assure constant dependable operation.

How an interesting heat recovery system is used to heat outdoor air for a mine is discussed by James G. Rutherford in his article beginning on page 114. The air exhausted from the mine at 61 F is passed over a coil containing water which picks up the heat from the air and reduces it to 40 F. With the large quantities of air circulated, approximately 1½ times the 7.2 million Btu per hr required to heat the outdoor air from -20 F to 30 F is obtained. Large quantities of water are circulated, of course, but no fuel is used. The application of this method to other underground areas also has possibilities.

Good maintenance procedures for heating, piping, and ventilating equipment builds profits, states Arthur F. DeLong on page 118 in a report of his presentation at the recent plant maintenance and engineering conference. He suggests that all forms of waste be removed, so that standards of use quantities can be developed for control purposes. He lists 19 ways in which heating costs can be controlled and shows how compressed air operating costs may be cut. The causes of high piping maintenance costs are given in some 13 reasons which should be considered. He also stresses the need for considering future service and maintenance when designing and installing a new system or an addition to an existing system.

"Give Him Some Air," says Albert B. Hubbard (page 123) in the "fifth round" of his series on winning the air conditioning odor fight. He says ventilation is a means that can be used to reduce odors below their thresholds where outdoor air flow rates can be kept at reasonable levels. He shows how required ventilation rates for removal of odors can be calculated before air conditioning is installed by following some simple mathematics.

Freeze protection is a "must" for steam heated industrial supply air systems, according to John H. Clarke in his discussion (page 125) of controls. He says freezestats are desirable, but are no positive protection against freezeups. Also suggested in his article is the importance of carefully sizing control valves and locating the thermostats where they can properly sense the temperatures they are assigned to control. He also suggests that where outside air and return air dampers are used, they should provide impingement and thorough mixing of the two air streams to prevent stratification.

Close temperature and humidity control are most essential in the new Brookhaven hospital-laboratory which has just recently been completed. Arthur C. Babcock discusses the design of the heating, air conditioning, and ventilation systems to meet the diversified needs of this new medical research center (page 134). He shows how 53 F well water, available at the site, is used to reduce the mechanical refrigeration capacity by two-thirds, and he explains how the air conditioning for the reactor building was designed. Some of the other systems used in this installation include finned tube radiation using 5 psi steam in the perimeter areas and a two-zone reverse return hot water heating system in the hospital area. Four air conditioning and five ventilation systems serve individual sections, according to the need, including special cold rooms that require constant low temperature and relative humidity conditions.

The application of cork insulation to cold pipe lines is the subject of the "HPAC Engineering Data File" this month. This report is on pages 139 to 158 and has been prepared in cooperation with James H. Shaw based upon over 20 years of experience at Eastman Kodak Co. where he was in charge of engineering, construction, and initial testing of all major industrial refrigeration systems. Mr. Shaw joined Carrier Corp. as director of laboratory services in 1954. This report shows how cork insulation may be applied to piping as molded sectional half cylinders or as lags and other forms. Whether lagged or molded covers are used, several precautions must be observed in designing and applying the insulation to obtain the best results. Among these are choosing the correct thickness for the service, filling all voids between the cork and the pipe or fittings, designing for proper loading of cork at the hangers, and designing hangers and anchors to meet the service conditions.

Attention must be given to selecting a good vapor seal, says Mr. Shaw in this report. He also stresses the need for protecting outdoor lines from the weather, protecting all lines from mechanical damage, painting exposed steel accessories such as hangers and supports, and proper inspection and maintenance. All of these various considerations are discussed in this report. Tables are also given for the selection of the type and amounts of accessories for a given job such as the quantity of wire or bands for fastening insulation, quantity of adhesive cement, seam filler, vapor seal, lag dimensions for insulation thicknesses from 1½ to 8 in. for application to pipe and tanks with dimensions for cutting lags, number of lags per course, number of sheets of cork required per course or per 3 ft of pipe, design of hangers, and hanger saddles.

Don't miss "Open for Discussion" on pages 89 to 92 and the answers to the question, "What Causes Our Pipe Fittings to Fail?" on pages 94 and 96. The HPAC Data Sheet on page 121 is a directory of engineering societies and associations and their addresses, brought up-to-date with all name and address changes that have occurred since the list was last published. "You'll Want to Know" is on pages 29 to 34, consists of many easily-read technical and business news items.

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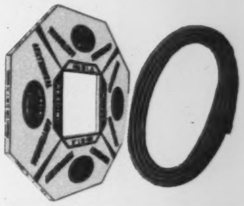

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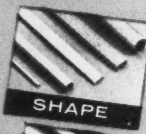

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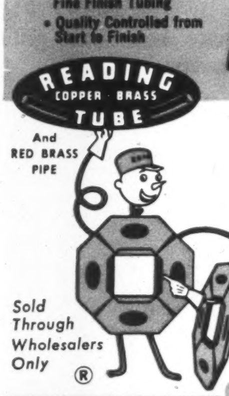

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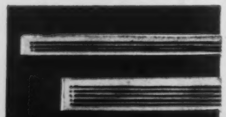

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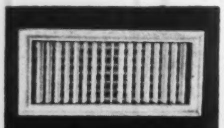

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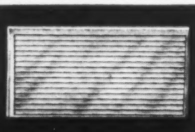

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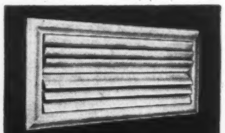

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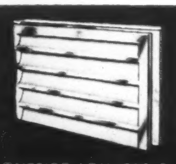

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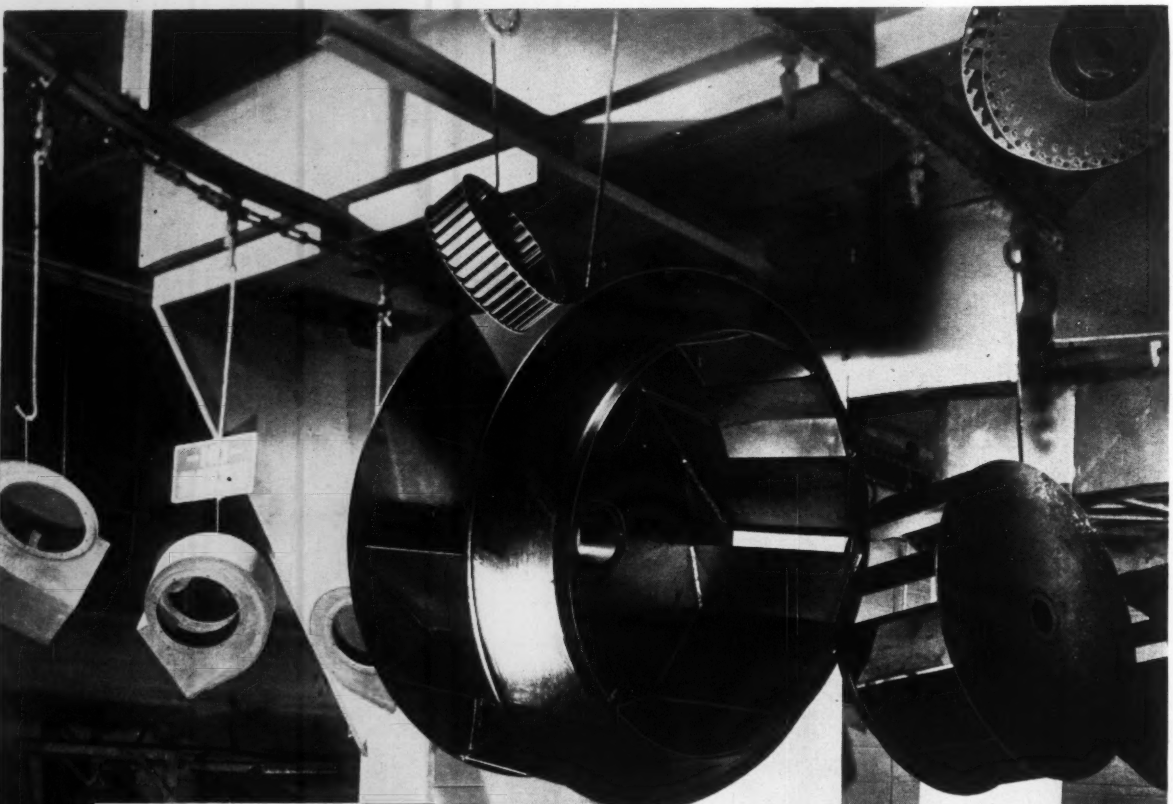

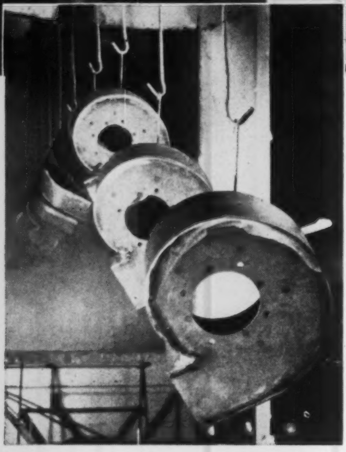

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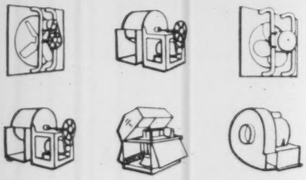

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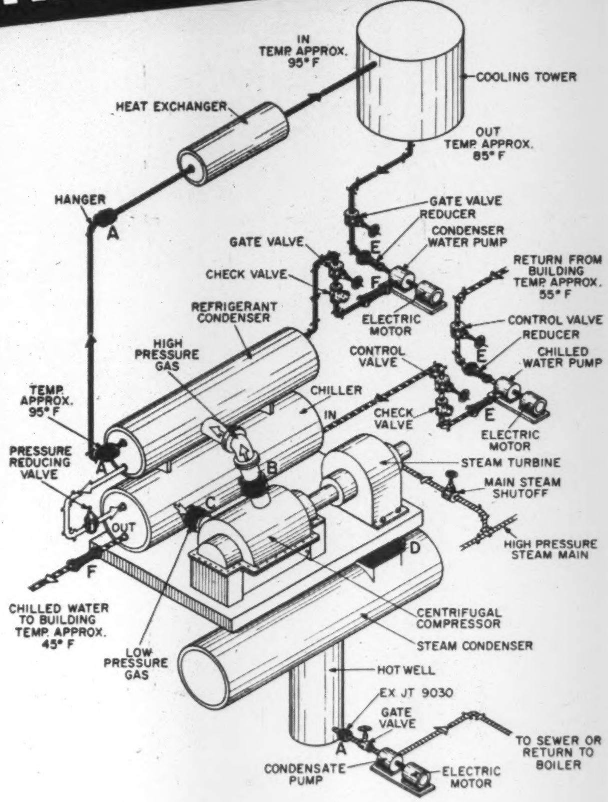
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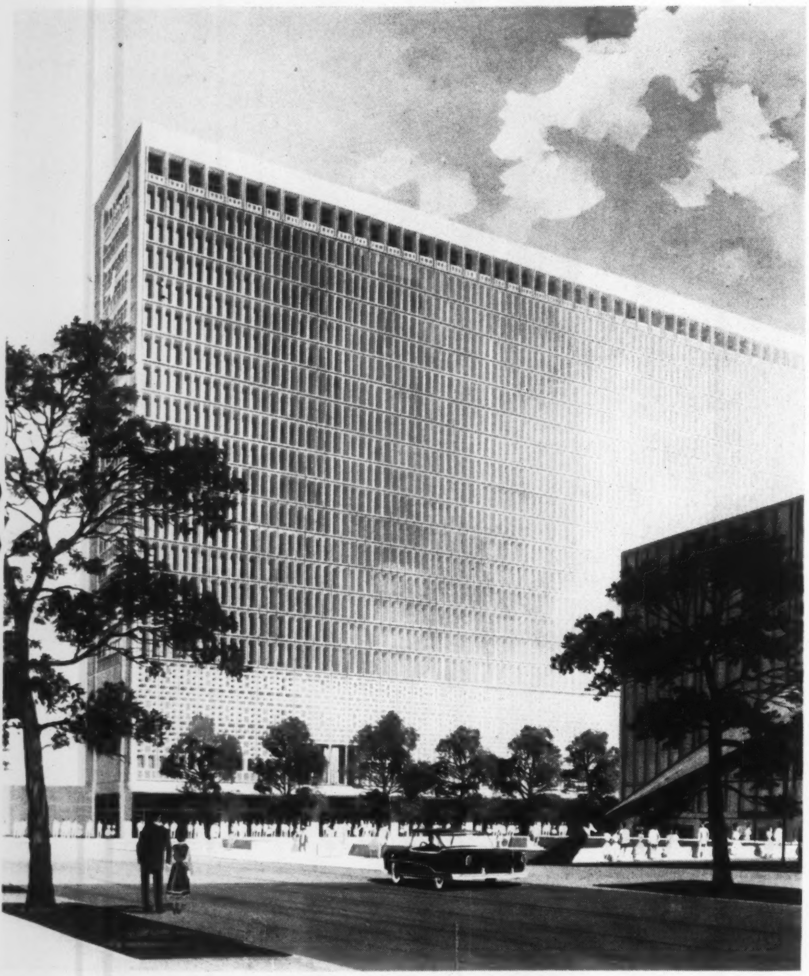

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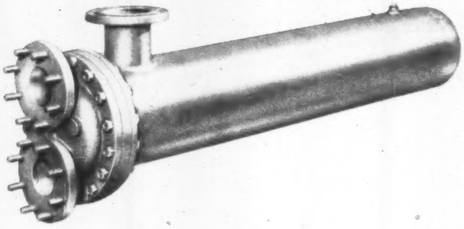

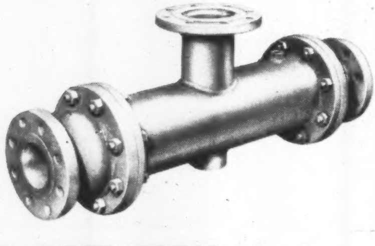

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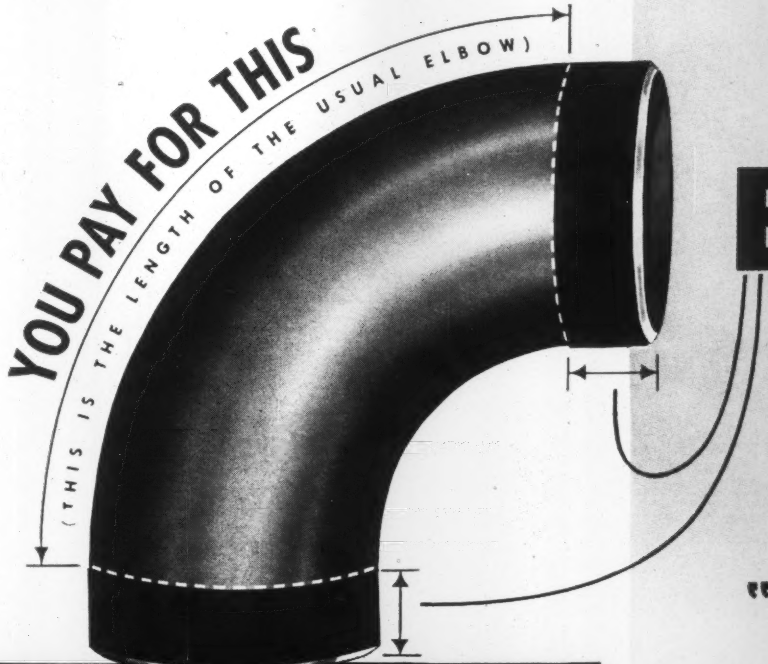
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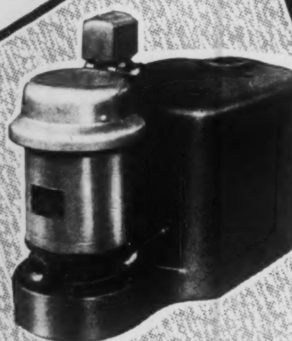

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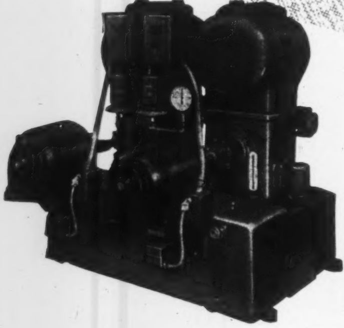

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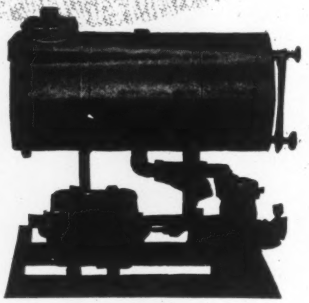

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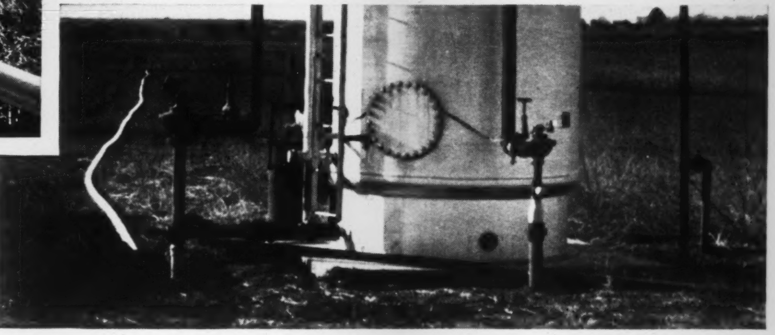

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Pipe made from Geon rigid vinyl saves time and work—it is so lightweight and easy to install. And maintenance costs are considerably lower.

Pipe of Geon is immune to galvanic corrosion, is highly resistant both to salt water and sour crude oil. It stays smooth inside and out. And it provides high tensile or impact strength, standing up under pressure.

Engineers are taking advantage of the unique properties of Geon pipe for a wide variety of applications. For information on how you can cut costs by using pipe of Geon, write Dept. AX-2, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.

Geon
Polyvinyl Materials

B.F.Goodrich Chemical Company
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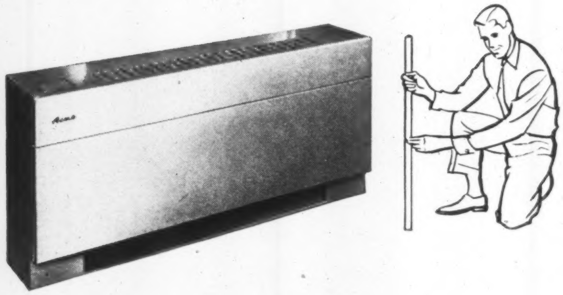
GEON polyvinyl materials • HYCAR rubber and latex
GOOD-RITE chemicals and plasticizers • HARMON colors

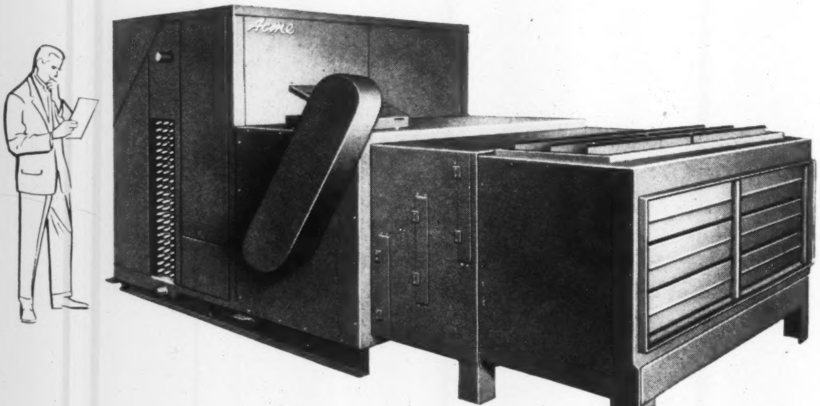
Acme ...the **practical** approach to air conditioning

REMOTE ROOM UNIT



AIR HANDLERS

MULTI-ZONE
AIR CONDITIONERS



NEW Acme AIR HANDLERS

COMPLETE SIZE RANGE TO 36,000 cfm

Now you can get famous Acme quality and dependability for the air handling section of almost any air conditioning system. From individual room units for motels, offices and other small room applications to big multi-zone units for large commercial and industrial buildings, every Acme air handling unit is designed and built for quality first. The result . . . you can count on Acme air handling units to deliver full capacity at the lowest possible sound levels and with minimum maintenance.

Each Acme unit is available with a full complement of accessories and optional equipment for complete flexibility of arrangement and installation to meet your requirements. The larger units are shipped in sections which may be stacked, installed side-by-side, hung from the ceiling or arranged in a variety of ways depending on space requirements. A full line of direct expansion, water and steam coils in matched capacities is an integral part of the line.

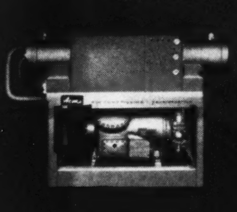
Cabinets are of sturdy welded steel construction with a thick blanket of heat and sound insulation wherever required. Most models in the smaller series are available without cabinets for concealed installation.

Complete Acme Systems

In addition to this great new line of air handling equipment, Acme offers a broad line of water chilling and water-conserving equipment, matched in performance with Acme air handlers to produce a complete air conditioning system—cooling, heating, filtering, humidifying, dehumidifying and ventilating—for almost any application. Acme also produces direct expansion packaged units in a wide size range. Whatever your air conditioning need, it will pay you to talk to the Acme Sales Engineer near you. Or write directly to the factory for complete information.

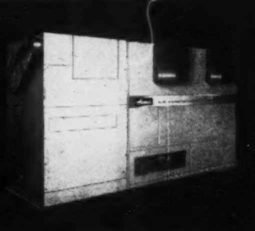
Acme
INDUSTRIES, INC.
JACKSON, MICHIGAN
Manufacturers of quality air conditioning
and refrigeration equipment since 1919.

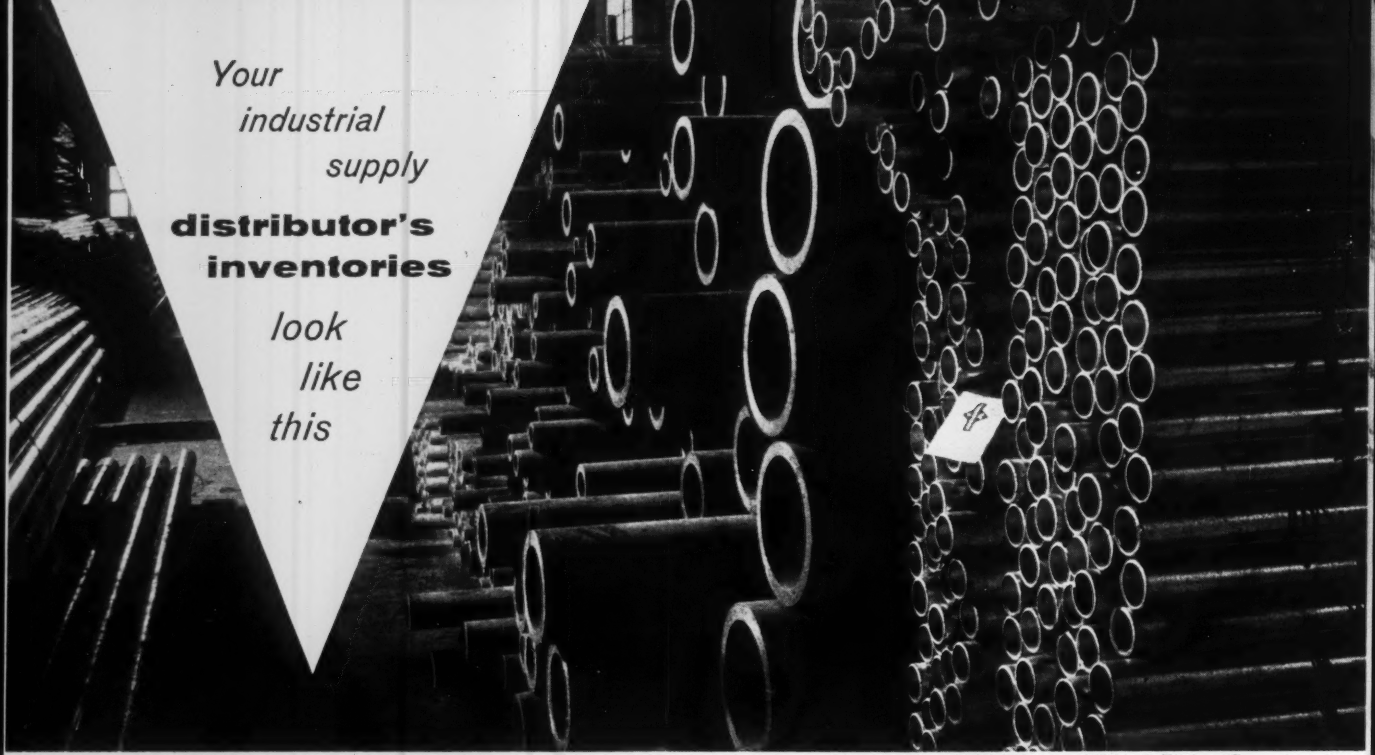
COMPLETE ACME SYSTEMS FOR EVERY AIR CONDITIONING NEED


Packaged Water Chillers

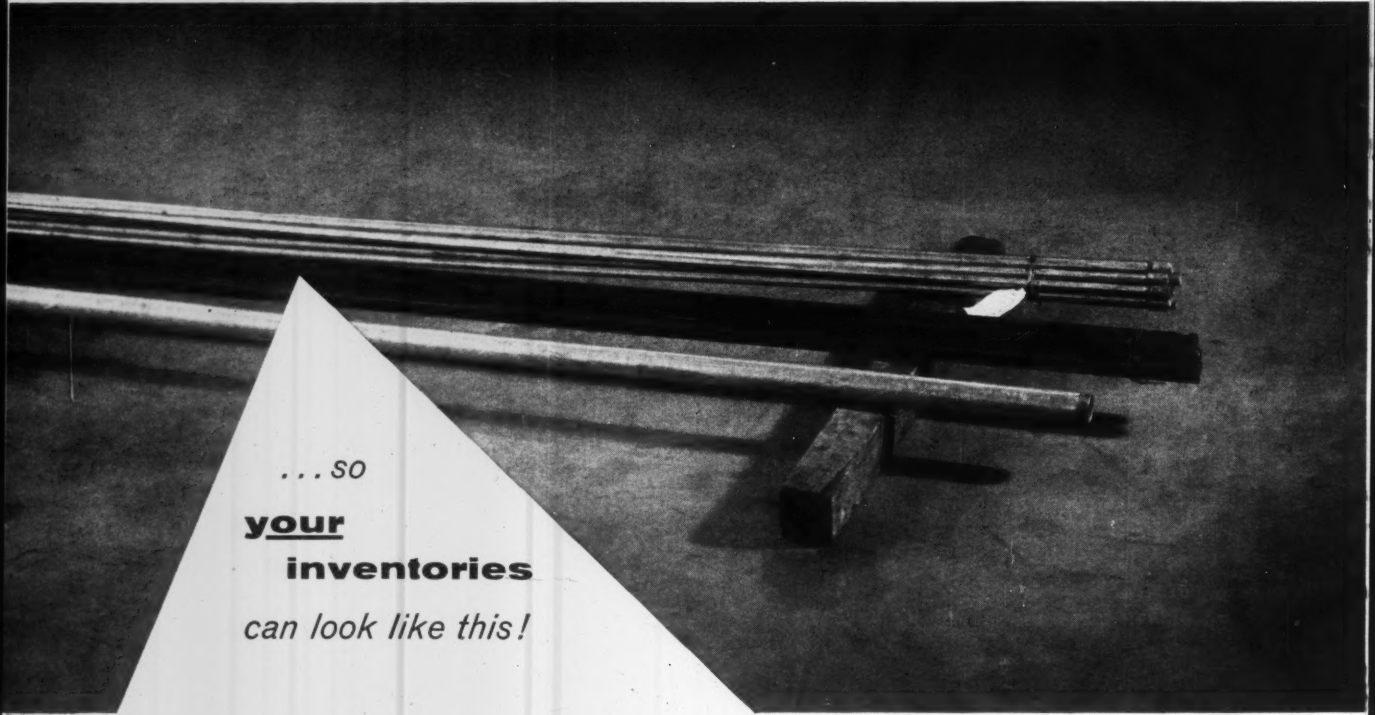
Indoor-outdoor Cooling Towers and Evaporative Condensers

Air-Cooled Condensers


Self-Contained Air Conditioners


Your
industrial
supply
distributor's
inventories
look
like
this

Photos courtesy of The Universal Valve & Fittings Company


. . . so
your
inventories
can look like this!

To cut inventory costs, make Youngstown's Industrial Supply Distributor your local dependable source for all steel pipe needs. Make full use of his complete local stocks, fast delivery service. His one-source service simplifies your purchasing and bookkeeping, too. You'll find him an efficient, time-saving, partner-in-production.

QUALITY YOUNGSTOWN SERVICE

THE
YOUNGSTOWN
SHEET AND TUBE COMPANY
Youngstown, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel

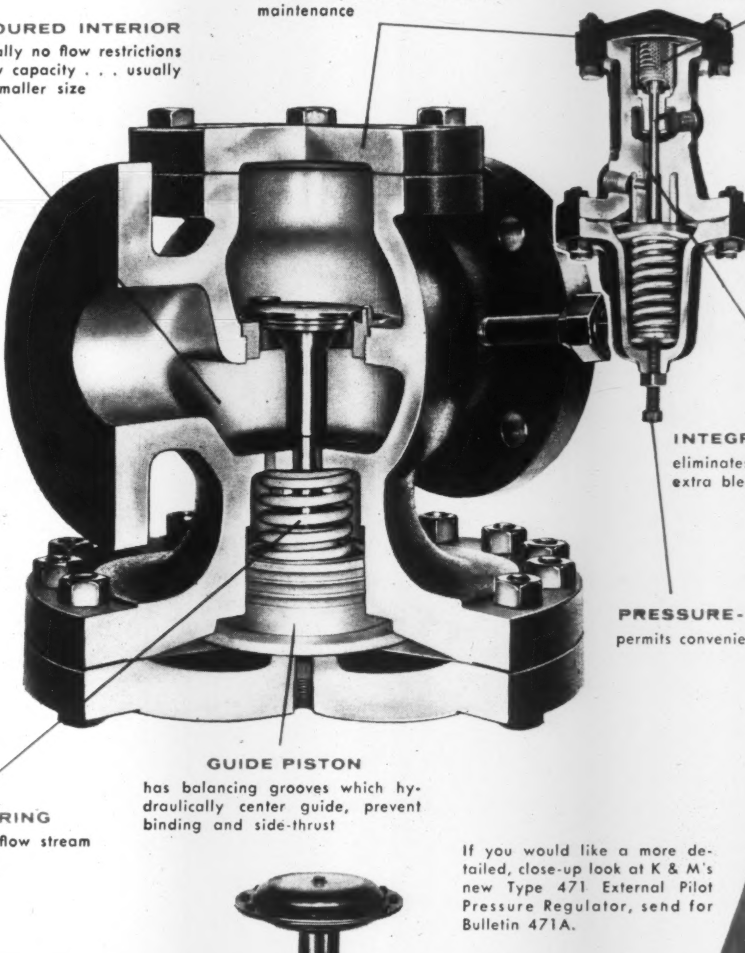
NEW... from K&M

EXTERNAL PILOT-OPERATED PRESSURE REGULATOR

fast-acting, accurate . . . tight shut-off even on dead-end service

Examine it yourself . . . feature for feature. K&M has made a vast improvement in external pilot-operated pressure regulators.

It simplifies installations: *requires one less pipe line.* It offers lowest maintenance: *the result of good hydraulic and mechanical design throughout.* It gives excellent performance: *try one and compare with any other regulator of its type.*



BLIND FLANGES
on both main valve and pilot allow easy access for routine maintenance

BUILT-IN STRAINER
protects pilot from scale, dirt, other foreign matter, is removable for cleaning

CLEANLY CONTOURED INTERIOR
has no spider, practically no flow restrictions . . . gives greater flow capacity . . . usually permits economy of smaller size

INTEGRAL BLEED ORIFICE
eliminates need for installation of extra bleed line

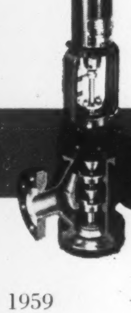
PRESSURE-ADJUSTING SCREW
permits convenient external pressure setting

GUIDE PISTON
has balancing grooves which hydraulically center guide, prevent binding and side-thrust

CONTROL SPRING
is isolated from main flow stream for greatest protection

If you would like a more detailed, close-up look at K & M's new Type 471 External Pilot Pressure Regulator, send for Bulletin 471A.

TYPE 471
EXTERNAL PILOT PRESSURE REGULATOR
KIELEY & MUELLER, INCORPORATED



K&M

diaphragm control valves

Our 79th Year

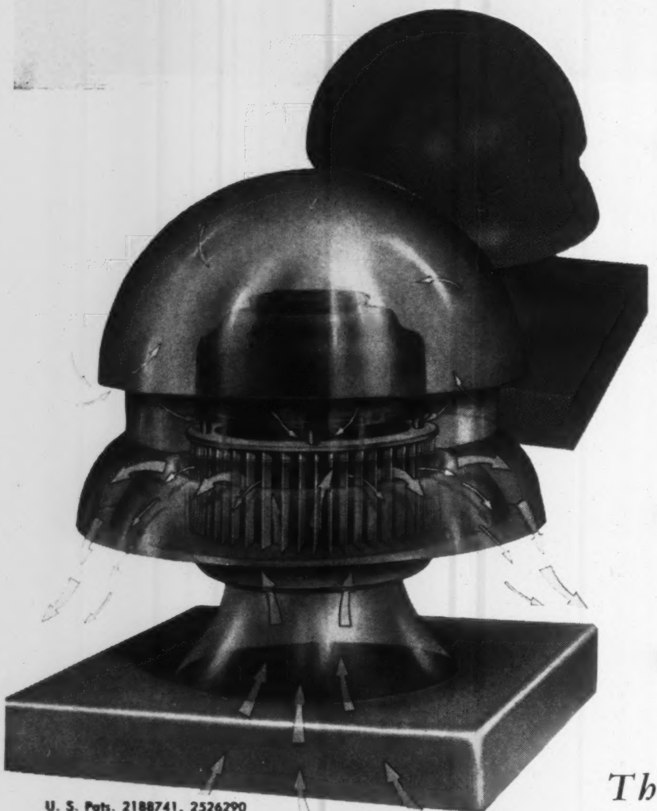
KIELEY & MUELLER, INCORPORATED

Oldest Pressure and Level Control Valve Manufacturer
64 Genung Street, Middletown, New York

S.A. 1808

Copying our FIBERGLAS*
idea is not enough...

to have a whisper QUIET power roof exhauster
like our **SUPER/AIR-VAN®** you must have—



U. S. Pats. 2188741, 2526290
Pats. Pending

- A research-developed, aerodynamic design that is patented and cannot be copied.
- A patented, scroll design to give efficient performance to 4" S.P.
- A true Venturi inlet.

  Glass smooth air passages.
- Customed designed motor isolators.

Then and only then will you get the whisper quietness of the first power roof exhauster in FIBERGLAS.

CAPACITY 100-12,000 CFM.
STATIC PRESSURE TO 4".

Units with less than 12" wheels do not carry AMCA seals because AMCA test codes do not apply to these small units.

CERTIFIED RATINGS
AMCA

Innovation *not* imitation

GALLAHER

The Gallaher Company 4108 Dodge Street Omaha, Nebraska

More than 100,000 Gallaher Air-Vans Have Been Installed.

*TM Owens-Corning Fiberglas Corporation

Heating
Piping &
Air Conditioning
May 1959

You'll Want To Know...

For news of new products, see the Equipment Developments department in this issue, and for new catalogs, bulletins, etc., see the Recent Trade Literature columns. Other news material also appears in the Who's What and the We Hear That departments. Meetings and Conventions are listed toward the back of this issue under that title, as are New Books and Reports.

Tells Heating Costs for All-Electric Installations

HEATING COSTS for three all-electric installations on the lines of the Commonwealth Edison Co., Chicago, ranged from 9.1c to 23.6c per sq ft per year, according to G. Gill Freyder, heating and air conditioning engineer with the utility, speaking at a session of the 21st American Power Conference in Chicago last month.

Among the installations observed over the past several years, three had been in operation long enough to obtain operating cost experience. The company now serves some 255 commercial electric space heating installations with a connected load of 6000 kw. Twenty-two of them are heat pumps and 233 resistance units.

Of the three for which operating costs were reported, one is a two story office building heated and cooled by a self-contained air source heat pump on each floor. The total seasonal power consumption for heating was 29,996 kwhr, which gave a total seasonal heating cost of 13.1c per sq ft of floor area. The demand varied from a low of 10 kw to a high of 31 kw during the heating season. Heat gains from lights and personnel provided a large percentage of the required heat.

Another structure for which data is available is a 7 story office building with a total floor area of 161,700 sq ft. This building is heated with glass panel resistance units having a total capacity of 250 kw. This building is not insulated (as would be recommended by the utility), since the electric heating was installed during a program of modernization. The total seasonal energy consumption for this building was 314,000 kwhr, with the demand varying from 45 to 184 kw. The seasonal heating cost amounted to 23.6c per sq ft.

The third structure on which he reported operating experience is a one story American Legion building heated and cooled by a 60 hp water source (private well) heat pump. The building has a floor area of 16,050 sq ft with a calculated heat loss of 581,000 Btu per hr. High internal heat gains and the efficient heat pump system result in a low operating cost of 9.1c per sq ft. This cost was based on a metered power consumption of 83,526 kwhr for all electrical services connected and the heat pump, including the circulating water pumps. Mr. Freyder noted that the cost would be appreciably lower if the ceiling of the structure were insulated.

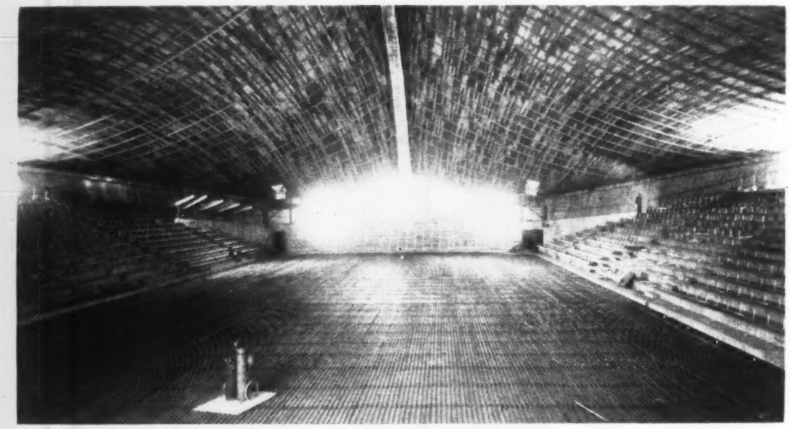
He also reported that an electrically heated school, the first connected load of its kind on his company's lines, was occupied on December 1. The school has a floor area of 28.934 sq ft and a calculated heat loss of 878.000 Btu per hr. A total of 346 kw electric heating capacity is installed. The classrooms are heated by electric unit ventilators and an all purpose room by resistance baseboard units. The saving in capital cost was about $25.000, based on the difference in total cost attributable to fuel and electric systems. (For example. the cost of 6 in. ceiling insulation. storm windows and doors and 2 in. foamed plastic insulation installed in the cavity of a brick veneer on block exterior wall were charged to the capital cost of the electric heating system.) Although the school has not been operated long enough to provide seasonal heating cost data. Mr. Freyder stated that the peak electric demand during the months of January and February. which were quite cold. was only 247 kw.

He described several other installations. though no operating data was available. One uses high temperature radiant heating elements (4000 F element temperatures) in a maintenance shop. This building is of steel frame and curtain wall construction. The heaters are 22 ft above the floor of the shop. The warm surface temperatures in this building are quite noticeable on entry, he said. It is interesting to note that the heating elements provide 50 foot candles of light at the working level in addition to the heating effect.

Another application uses a two stage air source heat pump with a capacity of 900 hp for a manufacturing plant with a floor area of 220,000 sq ft. Included in the plant area is an indoor swimming pool for employee use. The estimated heating and cooling requirements of this structure are 500,000 kw for cooling and 900,000 for heating, with demands ranging from 241 to 482 kw during cooling and 77 to 724 kw during heating. Since it is anticipated that the two stage heat pump will carry the heating load down to local design temperature (−10 F), no auxiliary resistance heaters are provided. The total connected horsepower of the system is 1200.

Ole A. Hill, Jr., marketing supervisor, Commonwealth Edison, spoke briefly at the same session on the use of electric resistance elements in floor panels. Several commercial types have been used and in addition, low voltage has been impressed upon reinforcing mesh in one installation to provide panel heating. He noted that one of the local commuter railways plans to use electric floor panels in new stations being built by the line. One of the reasons is that the heating equipment can't be tampered with. and also that it is easily controlled.

You'll Want To Know



New Yale Hockey Rink Has 46,000 ft of Pipe

THE NEW 85 × 198 ft hockey rink at Yale University in New Haven, Conn., recently completed at a cost of $1.300.000, has more than 46,000 ft of pipe installed, according to A. M. Byers Co.

To provide the cooling effect, brine will be circulated through $1\frac{1}{4}$ in. wrought iron pipe embedded in the center of a 5 in. thick concrete slab containing reinforcing rods. The pipe was held in place by metal chairs during the installation to assure uniform depth of bury in the slab. A plastic vapor barrier sheet 6 mils in thickness is below the 5 in. top slab. The vapor barrier was placed over a 2 in. screen slab laid directly on the ground. A $\frac{3}{4}$ in. asphalt impregnated felt was installed around the periphery of the concrete slab to provide for expansion and contraction.

The piping system is of the reverse return design without any balancing valves. The system was designed by the two consulting engineering firms of Jaros, Baum & Bolles and Peter Carver Associates as a joint venture.

Minneapolis Engineering Firm Takes New Name

THE CONSULTING ENGINEERING firm of Nielsen and Bruch of Minneapolis is now known as Bruch, Morrow and Knafla, Inc.

The partnership formed by Wallace C. Bruch and the late Borge Nielsen became prominent through work on many commercial, institutional, and industrial buildings.

Job Health Conference Attracts 3000

OVER 3000 occupational health specialists attended the recent Industrial Health Conference in Chicago.

Lectures and reports delivered at the conference covered a wide range of related subjects. Of special interest to the assembly were the remarks of R. J. Beaman, industrial hygienist with Procter & Gamble, and William E. Morgan of Boeing Airplane Co.

According to Mr. Beaman, his company makes use of high-speed movies as a tool in dust control. Because of the difficulty often encountered in locating the source of leaking dust by air sampling techniques, high speed photography has been used effectively in detecting dust cloud shapes and their sources.

In his lecture at the conference, Mr. Morgan pointed out that some startling effects are produced by airborne radar. It is generally conceded that the primary hazard to the body from radar microwaves is due to the heating effect. Injury does not occur instantaneously, but chronic exposure to high levels may cause tissue damage.

Tests conducted on small fur-bearing animals have emphasized the danger from microwave heating. But because such animals lack an efficient heat regulating mechanism, these tests do not necessarily reflect a corresponding danger to the human animal.

Said Mr. Morgan: Man has a very efficient heat regulating system which can resist the effect of microwave heat more effectively. Also, man is usually working in open areas where it is easy to lose body heat to the surrounding air.

Physical examinations have been given to personnel occupationally exposed to microwave radiation. The results of these examinations have showed no significant evidence of any temporary or permanent body changes or injury which could be attributed to causes of microwave radiation.

2 Panels Control Comfort in New Chase Bank Building

THE NEW Chase Manhattan Bank headquarters in New York City is said to be the largest air conditioned office building in the world, according to the Minneapolis-Honeywell Regulator Co. This 60 story building is scheduled for completion in 1960.

The cooling capacity to be installed will be 9140 tons. Four centrifugal compressors will be driven by steam turbines and are said to be the largest of their type to be installed. Cool water will be piped from the refrigeration machines to 6745 cooling units in all parts of the building. These same units will heat the building in the winter with hot water.

The comfort of 15,000 office workers and an estimated 10,000 daily visitors will be electronically controlled through two automatic control centers. Only two operating engineers will be required to adjust the comfort in any area desired. Twenty miles of electric wiring and 52 miles of pneumatic tubing will be used along with 450 room thermostats and 2466 other thermostats which will indirectly operate 3982 valves. Also, there will be 78 fans and 58 pumps installed that will be controlled through these centers.

New Standards Adopted by FCI

TWO NEW voluntary standards were adopted by the Fluid Controls Institute at its recent meeting in Chicago.

The new standards are "Definitions of Regulator Capacities" (FCI 58-1) and "Recommended Voluntary Standards for Measurement Procedure for Determining Control Valve Flow Capacity" (FCI 58-2). Single copies of the new standards will be sent to those requesting them at no cost. Additional copies are available at a cost of 20c for FCI 58-1, and 10c for FCI 58-2. Requests should be sent to the Fluid Controls Institute, Inc., 320 Broadway, New York, N. Y.

Gas Valve Requirements Approved by ASA

GAS APPLIANCE and equipment manufacturers are calling attention to the more stringent demands in the new American Standards Association list-

You'll Want To Know

ing requirements for relief valves and automatic gas shutoff devices for hot water supply systems.

The new requirements, effective at the first of the year, were approved by the ASA in October and sponsored by the American Gas Association. Copies are available at $1.50 each from the American Gas Association Laboratories, 1032 E. 62nd St., Cleveland 3, Ohio.

The relief valve division of the Gas Appliance Manufacturers Association has noted that the newest requirements strengthen the 23 year old standard replaced, and involve extensive changes in test procedure.

Gruman Resigns National Post for New York MCA Position

Lloyd B. Gruman, Jr., secretary of the Mechanical Contractors Association of America, Inc., announced recently that he was resigning to accept the position of secretary of the Mechanical Contractors Association of New York City.

Robert B. Miller, who has been secretary of the Mechanical Contractors Association of New York since 1930, has announced his intention of retiring July 1.

"Moving from the national office to that of the New York City association is only a change of focus for my efforts," Mr. Gruman explained at the time of the announcement. "Since this is one of the largest markets for our members' services, it will allow me to concentrate my efforts on the problems confronting heating, piping, and air conditioning contractors in this booming business," stated Mr. Gruman.

You'll Want To Know

GM Saves Billions of Gallons of Process Water

An estimated 72 billion gal of water were used for various industrial heating and cooling processes during 1957 by General Motors plants in the U. S. and Canada. According to David Milne, materials and processes supervisor for GM's Production Engineering Section, speaking before the recent American Power Conference in Chicago, this figure would have been much higher if it were not for the water conservation program instituted after World War II.

Mr. Milne explained that this water conservation program has produced two-way savings: for plant management in the form of reduced water charges; and for overstrained public water and sewer systems in some plant cities.

"The program has been carried out in four phases: 1) the review of plant facilities to determine conservation policies; 2) the dissemination of water conservation information and methods among employees and supervisors; 3) preventive maintenance checks of such items as leaky valves, faulty controls, etc.; 4) the study of water conservation from a long-range view," he said.

As a result of this campaign, in spite of plant expansion, water usage in plants and offices has decreased from 2,300,000 gal per day in 1949 to a current figure of 800,000 gal per day, he reported.

"Industrial water conservation," Mr. Milne concluded, "will benefit both community and manufacturer from at least three standpoints—making more water available to others, reducing the load on sewer systems, and lowering the cost of manufacturing."

Walter L. Fleisher Dies at 78

Walter L. Fleisher, well known heating and air conditioning engineer, died in New York City April 18 as a result of an automobile accident.

Mr. Fleisher was a member of HPAC's board of consulting and contributing editors. He was the author of an article on industrial air conditioning in the first issue, and he had prepared many articles for publication in these pages in the past 30 years.

In 1931 he became president of Air and Refrigeration Corp., the position he held at the time of his death. He had more than 100 patents and was a founder of the old Auditorium Conditioning Corp. In 1952 he became head of an advisory committee to the New York City Air Pollution Control Board. He was president of the American Society of Heating and Air-Conditioning Engineers in 1941. In 1954 he received the F. Paul Anderson award from the ASHAE.

Use Boilers to Thaw Seaway Locks

Four mobile package boilers will be used to thaw ice on the locks of the St. Lawrence seaway at Massena, N. Y., according to the Cleaver-Brooks Co.

Two 40 hp boilers will provide steam for melting the ice accumulated on the lock stop-logs. These stop-logs are barriers consisting of 10 steel plates 90 ft wide and 8 ft high.

Two stop-logs are lowered into slots on the canal side of the locks. These stop-logs are not completely water tight and there is a seepage of water through the cracks. This water freezes on the inside of the locks, up to thicknesses of 48 in.

Over each stop-log on the lock side a canvas cover enclosure approximately 90 ft wide, 80 ft high, and 10 ft deep will be formed. Into this enclosure on temporary supports will be placed two unit heaters of sufficient capacity to maintain a temperature of 70 F with outside conditions of 10 F.

The boilers, mounted on hard rubber wheels for portability, will be pulled into position and will feed steam at the rate of 1200 lb per hr to the unit heaters and to a steam gun which the operating crew can use to blanket the lock surface. The resulting blanket of steam and warm air will thaw the ice collected on the gate's surface, freeing the gate for action.

During the summer, the boilers will be used for steam cleaning of the locks, gates, machinery and other equipment subjected to oil accumulation.

Compressor Body Shipments Show Year End Rise

SHIPMENTS OF compressor bodies by manufacturers wound up for 1958 about 10 percent below the level of comparable shipments in 1957, according to the small compressor section of the Air-Conditioning and Refrigeration Institute. In contrast to the drop in total, shipments for the month of December, 1958 were about 20 percent higher than for December, 1957. This reflects a continuing steady upswing in this segment of the industry which began in August, 1958.

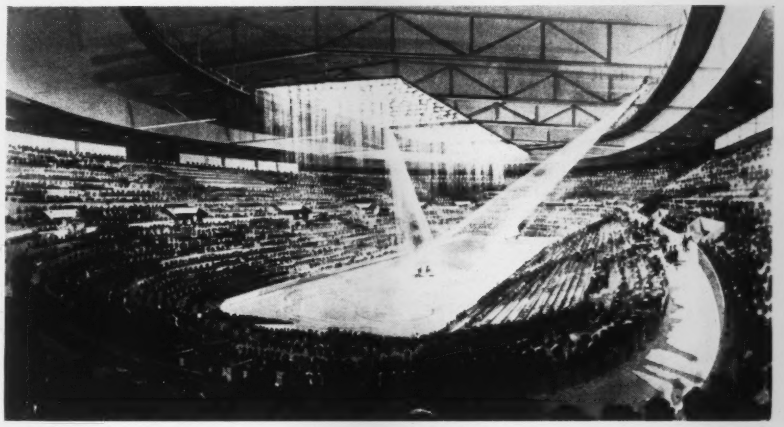
Actual shipments for 1958 totaled 3,559,057 bodies, compared with 3,962,142 in 1957. December shipments were 278,283 units, against 223,456 in December, 1957.

The figures, which include bodies for compressors used in all air conditioning and refrigeration equipment except household refrigerators, were compiled from reports to ARI by manufacturers whose output is estimated to be in excess of 95 percent of the industry.

Air Pollution Proceedings

The Proceedings of last November's National Conference on Air Pollution are now available. The 526 *page book may be obtained for* $1.75 *through the Superintendent of Documents, U. S. Government Printing Office, Washington* 25, *D.C.*

LA Arena Air Conditioning Poses Distribution Problems



THE NEW Los Angeles Memorial Sports Arena, one of the largest indoor sports arenas in the nation, will have an unusual air distribution system, because of the elliptical ceiling. There are no inside supporting columns to obstruct the view of the 22,500 spectators. The ceiling is supported by the largest span of steel in a commercial building west of the Mississippi.

Air conditioning in a structure of this magnitude is necessarily complex, since it must provide for a wide range of conditions. For example, 18,000 can be seated for basketball, and 15,000 for hockey.

The air distribution system was designed to serve the arena floor, concourse, and seating area independent of one another. For the permanent seating area there are eight central fan units located in an overhead furred soffitt. Each unit is designed to deliver 50,000 cfm of air to the arena. Individual units are equipped with outdoor and recirculation air dampers, combination return fans, exhaust fans and dual temperature heating and cooling coils. The piping system supplying these units is arranged as a two pipe reverse return water system providing chilled or hot water as required, according to Recold Corp.

The arena floor is served by six air handling units also located in the furred soffitt. These units supply either heating or cooling and each unit is thermostatically controlled for the temperature of the area it serves.

The concourse floor of the arena is treated as four zones with each zone having its own air handling unit capable of supplying either cooled or heated air. Ventilation by the individual systems is normally controlled thermostatically, but a central station control allows prompt correction if any area needs adjustment.

The Memorial Sports Arena has been selected as the site for the 1960 Democratic nominating convention, the first in Los Angeles. At the time of the selection, a spokesman for the Democratic party stated that a major consideration was the fact that the sports arena was air conditioned.

The air conditioning and heating systems were designed by the mechanical engineering department of the architectural and engineering firm of Welton Beckett and Associates. The system is being installed by Western Air and Refrigeration Inc.

You'll Want To Know

You'll Want To Know

Building Contracts Continue to Climb

Construction contracts in the U. S. — excluding Alaska — totalled $2.3 billion in February, setting a new alltime record for the month, 18 percent above February, 1958, according to F. W. Dodge Corp.

"The most encouraging feature of the new figures was the first upturn in industrial building contracts since the recession," said Dr. G. C. Smith, vice president of the Dodge Corp. "This category is an important indicator of economic conditions ahead, and the fact that it rose by 37 percent over February, 1958 is highly significant of business optimism about the future," he said.

Non-residential building contracts in February totalled $704,337,000, down 6 percent below February, 1958. The decline was primarily accounted for by decreases in contracts for offices, schools, and public buildings. Increases were reported for stores, factories, hospitals, and social and recreational buildings.

Management People Must Have 'Feel' for Things Technical

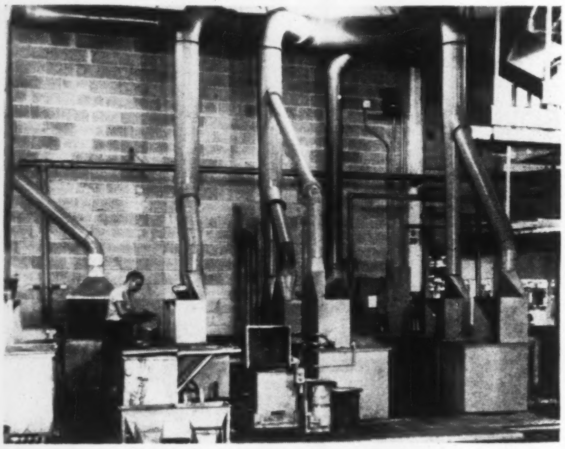
Both technology and population are "exploding"—and these "explosions" force new dimensions in management development, said Willard F. Rockwell, Jr., president of the Rockwell Mfg. Co., in an address at the American Power Conference, held recently in Chicago.

He said that he doesn't believe that management people in business or government can make sound decisions without having a far greater understanding of the meanings of technological progress than most of them have today. "All management people must have more than man-on-the-street's background, a *feel* for things technical," he said.

The widely accepted concept that technical people should have some formal training in the humanities should be turned about, he stated, so that nontechnical management people should be exposed to formal college-level survey courses in technology.

Technology demands as much of our nontechnical people as the humanities demand of our technical people, he concluded.

UPVC Piping Carries Water, Acid in Plant's Plating Department



An installation of unplasticized polyvinyl chloride (UPVC) piping is reported reducing costs, increasing operating efficiency and improving quality control in the plating department of the National Lock Co's plant at Rockford, Ill., that turns out some 17 million screw-type fasteners a day.

The plant uses 1 and 2 in. UPVC lines to carry deionized water to counterflow rinse tanks in the barrel plater; 1, 1½, and 2 in. lines to carry 37 percent muriatic acid to acid dip tanks; and 3 and 4 in. lines throughout the plating department to carry spent acid solution to treatment tanks. These solutions include hydrochloric, nitric acetic, phosphoric, and other acids of varying concentrations. Operating conditions are 40 psi at temperatures from 60 to 90 F according to Tube Turns Plastics, Inc.

Where UPVC pipe is flanged to metallic equipment such as pumps and valves, neoprene gaskets are used. Horizontal piping is supported by metal swing hangers spaced 3 ft apart.

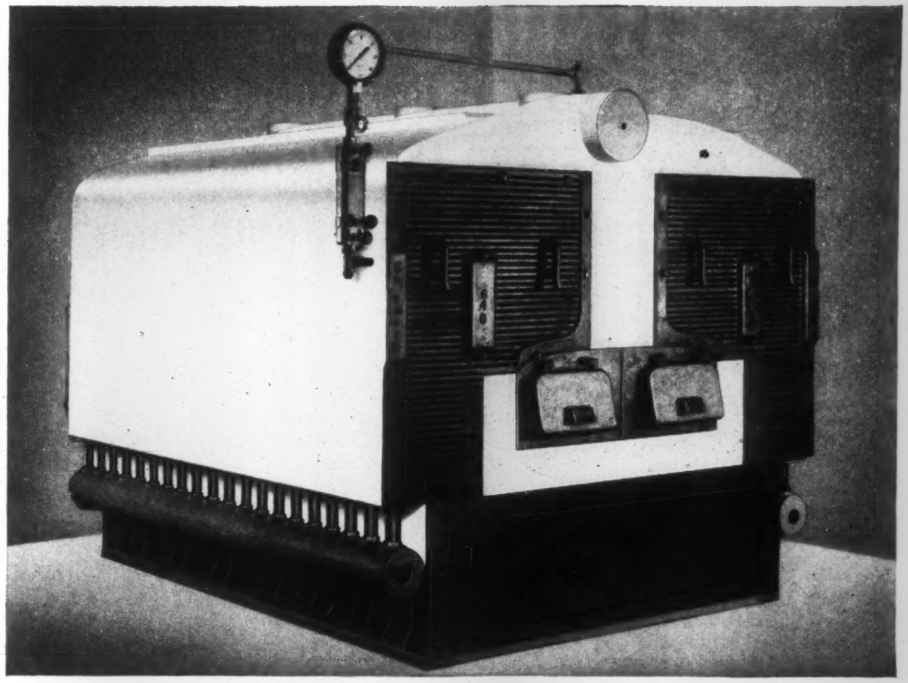
Unplasticized polyvinyl chloride was chosen for this piping installation because of its resistance to corrosion, external as well as internal; the absence of galvanic or electrolytic action; and the protection of acid and makeup water from discoloration and contamination, due to the absence of scale in the UPVC lines.

Promote Room Air Conditioners May 17-24

"Beat the Heat With an Air Conditioner" is the theme chosen by the room air conditioner section of the National Electrical Manufacturers Association for its first united sales promotional campaign.

The campaign will be highlighted by "Beat the Heat Week"—May 17-24. Purpose of the "Week" is to acquaint the public with the latest developments in room air conditioners, and to encourage prospective purchasers to make their selections in advance of hot weather.

H. B. SMITH "BIG MILLS 640"



. . . a new 100-200 horsepower boiler for horizontal rotary oil or gas burners

H. B. Smith has answered the urgent request of Consulting Engineers and Heating Contractors. Five years of intensive research and development have gone into a Mills cast iron water tube boiler in the 100 to 200 horsepower class.

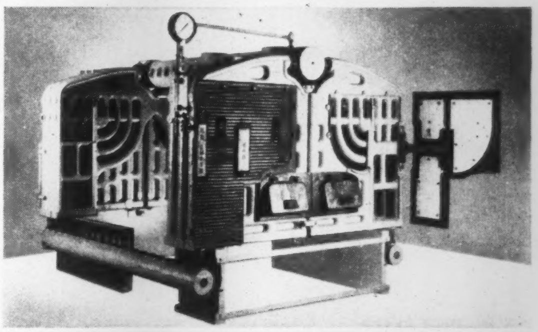
BIG MILLS 640 Cast Iron Water Tube Boiler represents the ultimate in cast iron boiler engineering, metallurgy, coring, casting and precision machining.

In addition to its economy and efficiency with horizontal rotary oil burners or gas burners, the 640 combines the long life and other unique features which have distinguished Mills boilers for so many years.

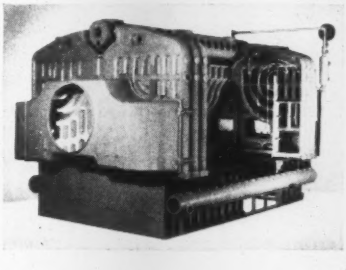
Sizes run from 10 to 20 sections, and all sizes operate with natural draft with *55-foot chimneys* – lower than are required by any other cast iron or steel boilers of comparable size.

Any large commercial, industrial or institutional building will benefit through the use of the 640 – and the fact that sections can be moved through conventional entrances and the boiler assembled on the site makes it the natural choice for replacement in these buildings.

Write for the bulletin which illustrates and decribes the BIG MILLS 640 in full and contains complete engineering information.



Cutaway view shows the Mills flue construction which exacts maximum value of the fuel used. Large insulated flue doors hinged on extension arms, swing to one side to permit easy access for cleaning all flues.



Rear view shows the smoke hood and stack connection. Intricate flue travel assures low stack temperatures and permits use of low chimney.

H.B. Smith CAST IRON BOILERS

H. B. SMITH CO., INC., WESTFIELD, MASSACHUSETTS • *Established 1853*

Announcing another ELECTRO-AIR EXCLUSIVE feature . . .

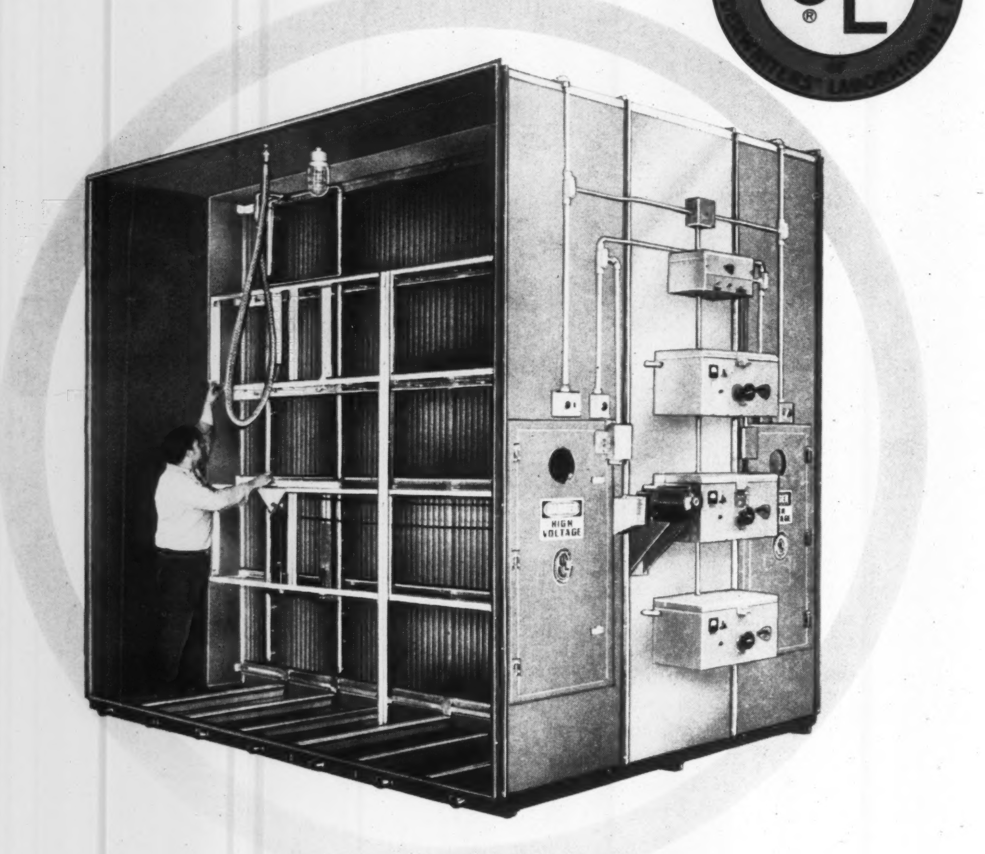
NOW! This symbol of safety is being affixed to all ELECTRO-AIR "Custom Line" and "Built-Up Line"

COMPLETE ELECTRONIC AIR CLEANER UNITS

(ENCLOSURES . . . CONTROLS . . . CLEANING AND ADHESIVE SYSTEMS)

UNITED STATES REEXAMINATION SERVICE OF UNDERWRITERS' LABORATORIES, INC.

UL®



Mr. Engineer:
When you specify the safest you specify the finest—ELECTRO-AIR!

An Electro-air Commercial and Industrial Electronic Air Cleaner, with the new DAX cleaning and adhesive system,* is the most efficient . . . the most service-free unit on the market.

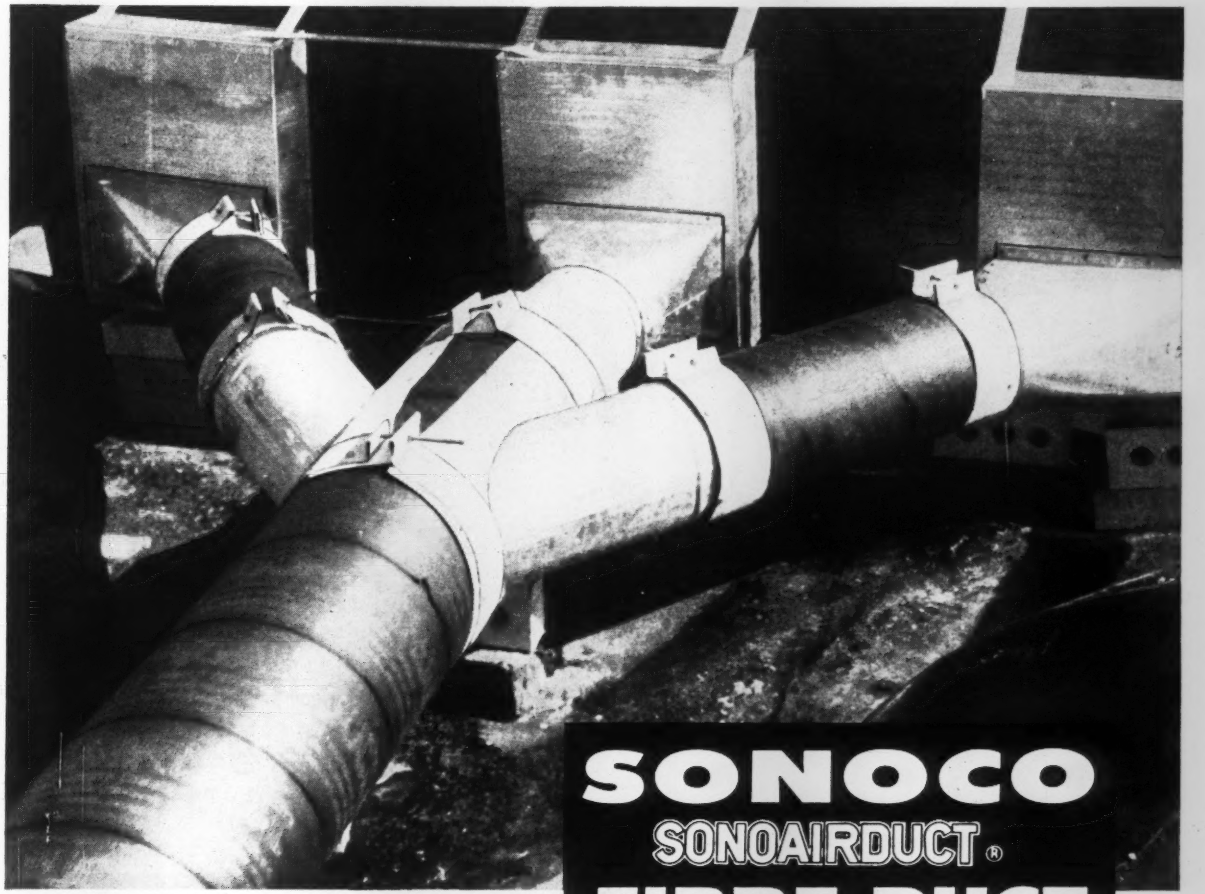
*Listed under Reexamination Service of Underwriters' Laboratories, Inc.

ELECTRO-AIR
ELECTRONIC AIR CLEANERS

ELECTRO-AIR CLEANER CO., INC.
Olivia and Sproul Streets
McKees Rocks, Pa.

SEND FOR FREE LITERATURE which gives complete technical information on Hi-C equipment and DAX.

more sold in 1958 than ever before



SONOCO
SONOAIRDUCT®
FIBRE DUCT

SONOAIRDUCT in diameters up to 30" is shown being installed in St. Paul's Lutheran Church, Dallas, Texas. Eugene Wakasch, Architect, Austin, Texas; Stone Company, Sub-contractor, Dallas.

Ever-increasing sales are proof that builders and contractors recognize the many advantages of this quality product! Since SONOAIRDUCT was introduced nearly ten years ago, the number of users of this economical fibre duct has grown continuously. Check these time and money-saving advantages. Initial cost is low. The long lengths are easy to handle, install and level. It can be sawed to exact lengths on the job. No sharp, cutting edges—won't chip, crack or break when dropped.

Sonoco SONOAIRDUCT is made especially for slab perimeter heating or combination heating and cooling systems where duct is encased in concrete. It meets and exceeds F.H.A. criteria and test requirements for products in this category. 23 sizes—2" to 36" I.D., in standard shipping lengths of 18'. Special lengths also available. Free installation manual. See our catalog in Sweet's.

For complete information and prices, write—

- HARTSVILLE, S. C.
- LA PUENTE, CALIF.
- MONTCLAIR, N. J.
- AKRON, INDIANA
- LONGVIEW, TEXAS
- ATLANTA, GA.
- BRANTFORD, ONT.
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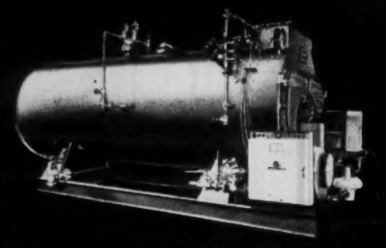
SONOCO
Construction Products

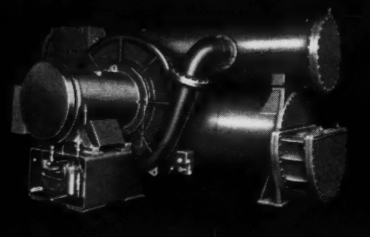
400

SONOCO PRODUCTS COMPANY

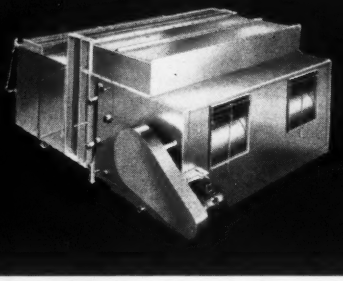
Calling in equipment on your



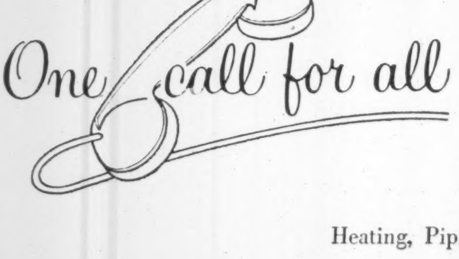
Firebox, scotch-type steel boilers and package units for heat, power, steam.



Centrifugal refrigerating machines for central-station air-conditioning systems.



Central-station air-conditioning units for public buildings, industrial plants.

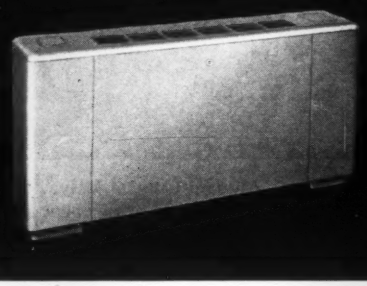


representatives
air-conditioning job?

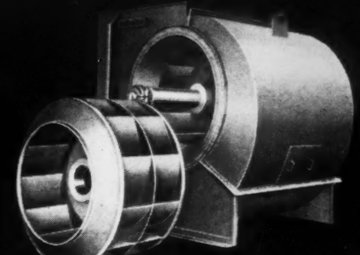
Be sure one of the representatives you call is from

American-Standard Industrial Division

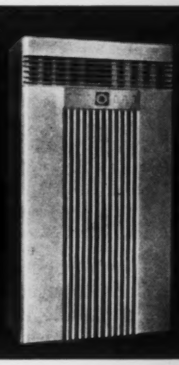
You benefit by discussing equipment-selection with an engineer. American-Standard* Industrial Division is engineer-staffed from brass to branches. Combining three American-Standard divisions — American Blower, Ross Heat Exchanger, Kewanee Boiler — this new organization offers *one-source responsibility* for quality and performance in equipment designed, engineered, and manufactured to work together. There are offices in all principal cities to assist you — from the planning stage on. Contact the one nearest you. American-Standard Industrial Division, Detroit 32, Mich. In Canada: American-Standard Products (Canada) Limited, Toronto, Ontario.



Fancoil units for cooling and heating individual rooms in multi-room structures.



Heavy-duty centrifugal fans for high pressure air conditioning or ventilating needs.



Packaged commercial air conditioners, air- or water-cooled types, 3 to 20 tons.

*American-Standard and Standard ® are trademarks of American Radiator & Standard Sanitary Corporation.

AMERICAN-Standard

INDUSTRIAL DIVISION

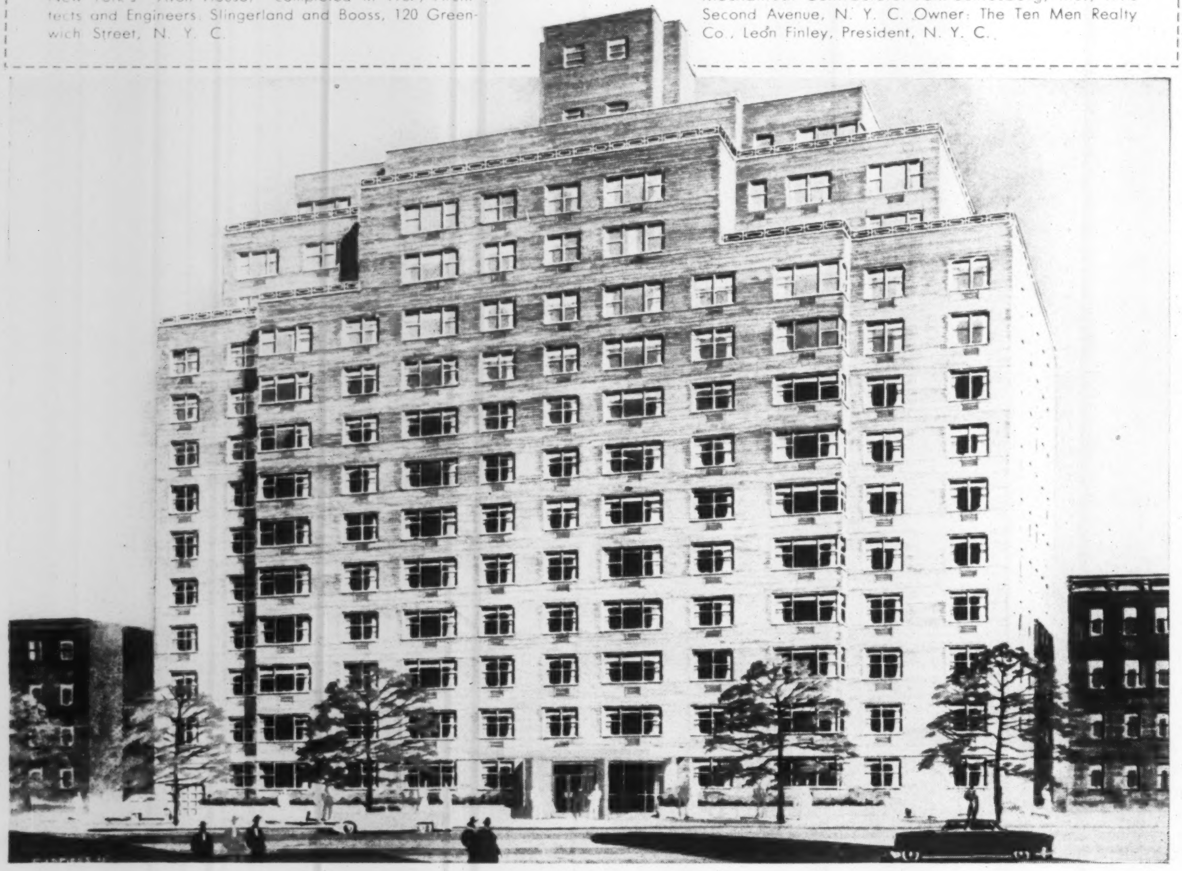
AMERICAN BLOWER PRODUCTS • ROSS PRODUCTS • KEWANEE PRODUCTS

"WE SECURED EVEN TEMPERATURES THROUGHOUT THIS 14-STORY BUILDING WITH SARCOTHERM HEATING SYSTEM CONTROLS,"

say Slingerland and Booss, architects and engineers

New York's "Avon House," completed in 1957, Architects and Engineers: Slingerland and Booss, 120 Greenwich Street, N. Y. C.

Mechanical Contractors: Fein-Schlosberg, Inc., 1770 Second Avenue, N. Y. C. Owner: The Ten Men Realty Co., Leon Finley, President, N. Y. C.



In the superbly appointed "Avon House" apartments at 340 East 74th Street, New York, the complete automatic heating control job is Sarcotherm. The architects and engineers, Slingerland and Booss, called on Sarco's experienced engineering department to work with them and the mechanical contractor in working out components—controls, vacuum pumps and steam specialties. Besides setting up undivided responsibility of one manufacturer, this policy assured a balanced system with no weak links.

Accurate orifice calculations by Sarcotherm insured proper distribution of subatmospheric steam in the system, even in mild weather. Each of the 2 zones of this building is controlled by a Sarcotherm Continuous Flow Modulating Steam Control Valve. These valves meter the steam to furnish proper heat at any given outside temperature. Control Valves are influenced by outside temperature, wind velocity, and solar radiation, plus differential steam pressure between supply and return mains. A Master Control Panel supplies complete programming operation with automatic control for day, night and morning pickup cycles.

There is ample testimony to the sound judgment of the architects in making this a complete Sarcotherm vacuum heating control system. Since its first day of operation the installation at the new Avon House has been 100% trouble-free.

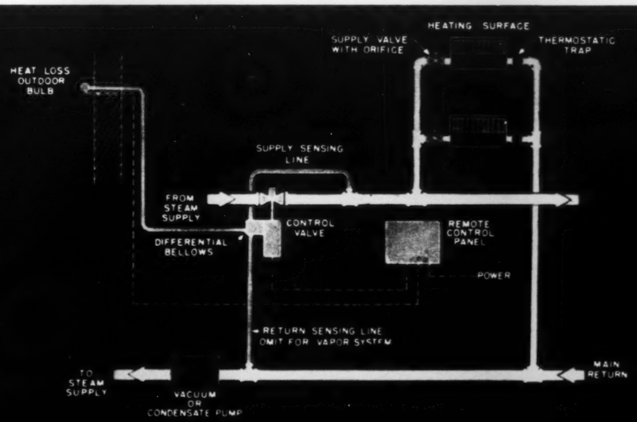
SARCOTHERM

An Affiliate of SARCO Co., Inc.

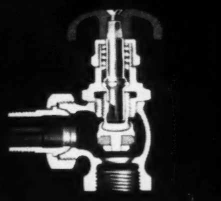
635 Madison Avenue, New York 22, N. Y.

"INSTALLATION WAS EASY, THANKS TO SARCOTHERM ENGINEERING SERVICE AND UNDIVIDED RESPONSIBILITY FOR CONTROLS, SPECIALTIES, PUMPS,"

say Fein-Schlosberg, Inc.,
mechanical contractors

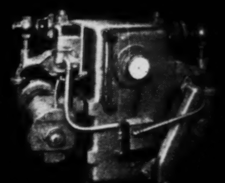

HEATING SURFACE
SUPPLY VALVE WITH ORIFICE
THERMOSTATIC TRAP
HEAT LOSS OUTDOOR BULB
SUPPLY SENSING LINE
FROM STEAM SUPPLY
CONTROL VALVE
REMOTE CONTROL PANEL
DIFFERENTIAL BELLOWS
POWER
RETURN SENSING LINE OMIT FOR VAPOR SYSTEM
TO STEAM SUPPLY
MAIN RETURN
VACUUM OR CONDENSATE PUMP

This schematic hook-up shows continuous-flow Sarcotherm System



Sarco No. 1141 Spring-Packless Steam Radiator Valves, Type H Radiator Traps and Type FT Float-Thermostatic Steam Traps are used.

This WFA-X6 Control Panel has supply and return pressure gauges.



DVA Duplex Vacuum Pump is furnished complete with magnetic starters, float switch and vacuum regulator.

Marked advantages were found by the mechanical contractors in the quality of orifice engineering provided by Sarcotherm. Every valve, for example, was calibrated and the orifice plate brazed in at the factory. All units were tagged, unit-packaged, and keyed in with the hook-up drawing. The installation was supervised by Sarcotherm engineers. The installation was rapid and easy. No on-the-job adjustments were necessary.

SARCOTHERM

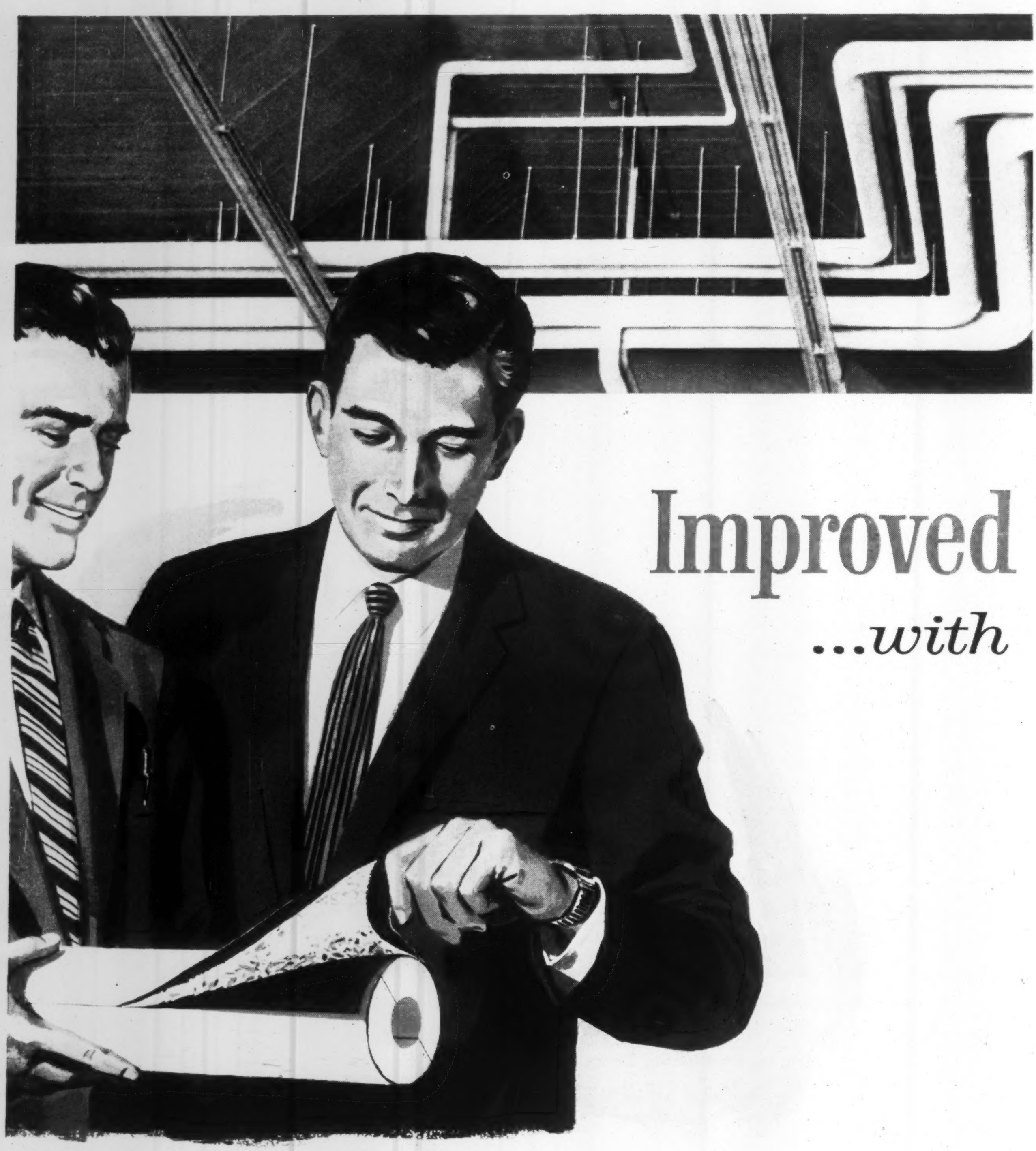
An Affiliate of SARCO Co., Inc.

*

FOR COMPLETE CONTROL SYSTEM CATALOG

write Sarcotherm Controls, Inc.,
635 Madison Ave., New York 22, N. Y.

6176 B

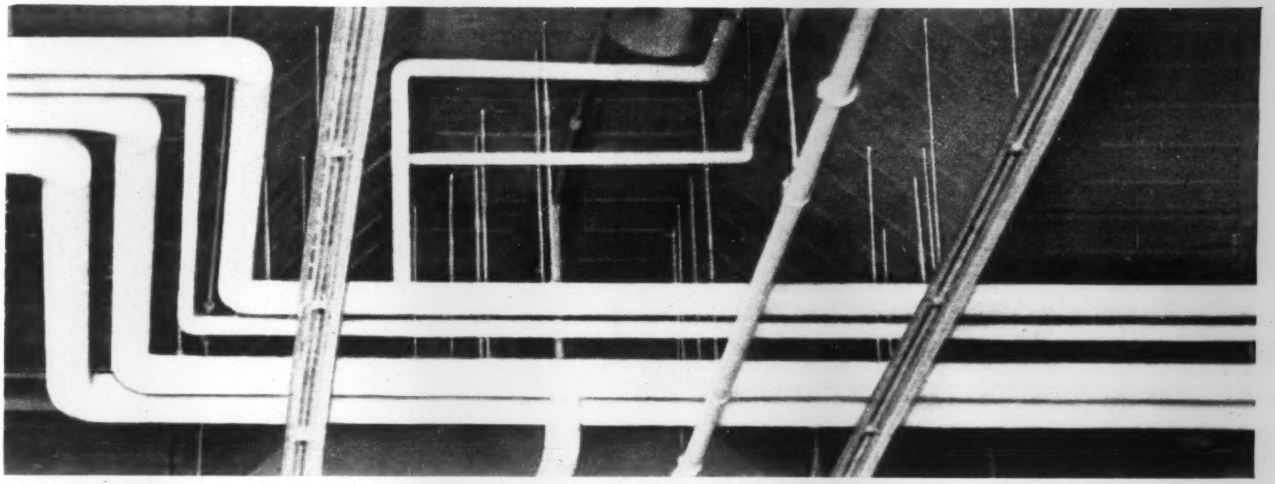


Improved

...with

One look and you know it's Fibrocel ...the only molded insulation for commercial pipelines...in attractive new VS and VB jackets.

Installs easier, faster . . . because its size and shape never vary. Butt straps go on easier, too.



JOHNS-MANVILLE ANNOUNCES . . .

Fibrocel Insulation

2 new types of white jacketing

Easier to install · More attractive · Thermally effective · Priced low for substantial savings

TEST IMPROVED new Fibrocel®—even on just a short run of pipe—and see the difference! See why this rigid, molded insulation makes an installation so many ways better!

First thing you notice about Fibrocel is that it's molded. For only an unvarying metal mold can produce such nearly perfect roundness, such uniformity of size and shape. The result—less time needed to get the neater, better fitting job you want . . . with the pipeline always dead centered in the insulation for top insulating value.

Rigidity is another Fibrocel advantage. Working with a rigid material, butt straps go on easier, faster. And your inspection (whether one day or one year after installation) reveals not a sign of denting, bulging or "fish mouthing"—so common with soft insulations.

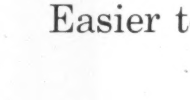
New White Jackets

Fibrocel now comes in virtually any jacket you'll ever need. *New Type VS* is richly creped, pure white kraft backed by 1/3-mil foil. One painting provides complete coverage. Yet it's priced as low as canvas. Then, there's new *Type VB*. Priced slightly higher—but well worth it! Outer surface has same rich creping as Type VS, inner vapor barrier is full mil thickness of aluminum foil, pipe facing is creped black kraft. Creping permits surfaces to "move" with foil as moisture conditions vary. Fibrocel is also available with "Type C" canvas finish.

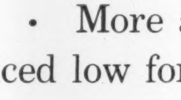
Let us send you a copy of IN-155A, the informative 8-page Fibrocel folder. Write for it today. Address Johns-Manville, Box 14, New York 16, New York. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE

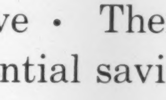
JOHNS-MANVILLE JM PRODUCTS



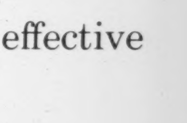
More attractive. Rigid, dimensionally uniform, Fibrocel fits tighter, neater. Jacket doesn't dent, bulge or "fish mouth."



Insulates better. Because Fibrocel is perfectly round, pipe is always "dead center," for maximum insulating value.



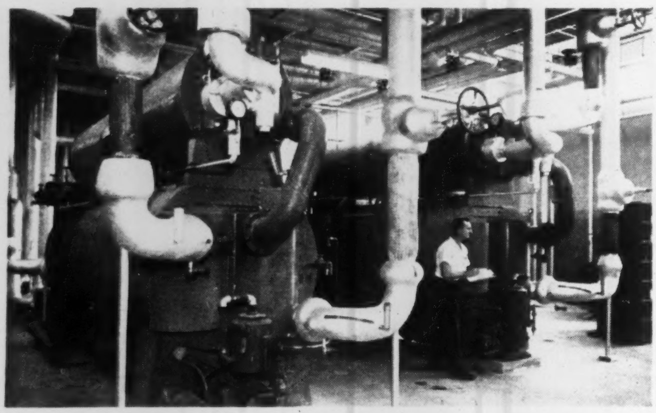
Costs less. Don't let Fibrocel's appearance and efficiency mislead you. It's priced low!



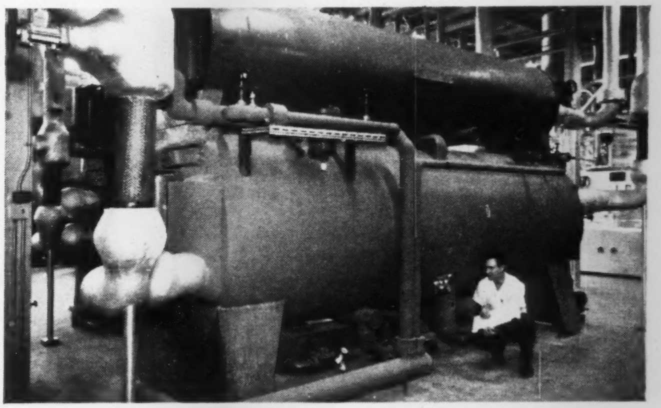
Takes abuse . . . in rough service . . . keeps its "just installed" appearance through years of service.

NO SUMMERTIME SLUMP With gas as the boiler fuel and York machines, the switch to summer cooling was no problem. Operating costs are low, too, thanks to Gas.

LATEST IN COOLING Gas operated York machines feature the use of tap water as refrigerant and lithium bromide as absorbent, one of the most efficient, practical refrigeration cycles developed so far. Machines start and stop automatically.



THE UTMOST IN FLEXIBILITY The units are cross-connected so that each operates independently if necessary.



MAINTENANCE COSTS TO DATE—ZERO! The Allen Company uses two York machines—a 230-ton unit serving 45,000 sq. ft. of office and cafeteria space, a 170-ton unit for process water cooling. Three small pumps and motors are the only moving parts in the entire system.

"with **YORK**
GAS *air conditioning*
our boilers keep us cool
all summer"

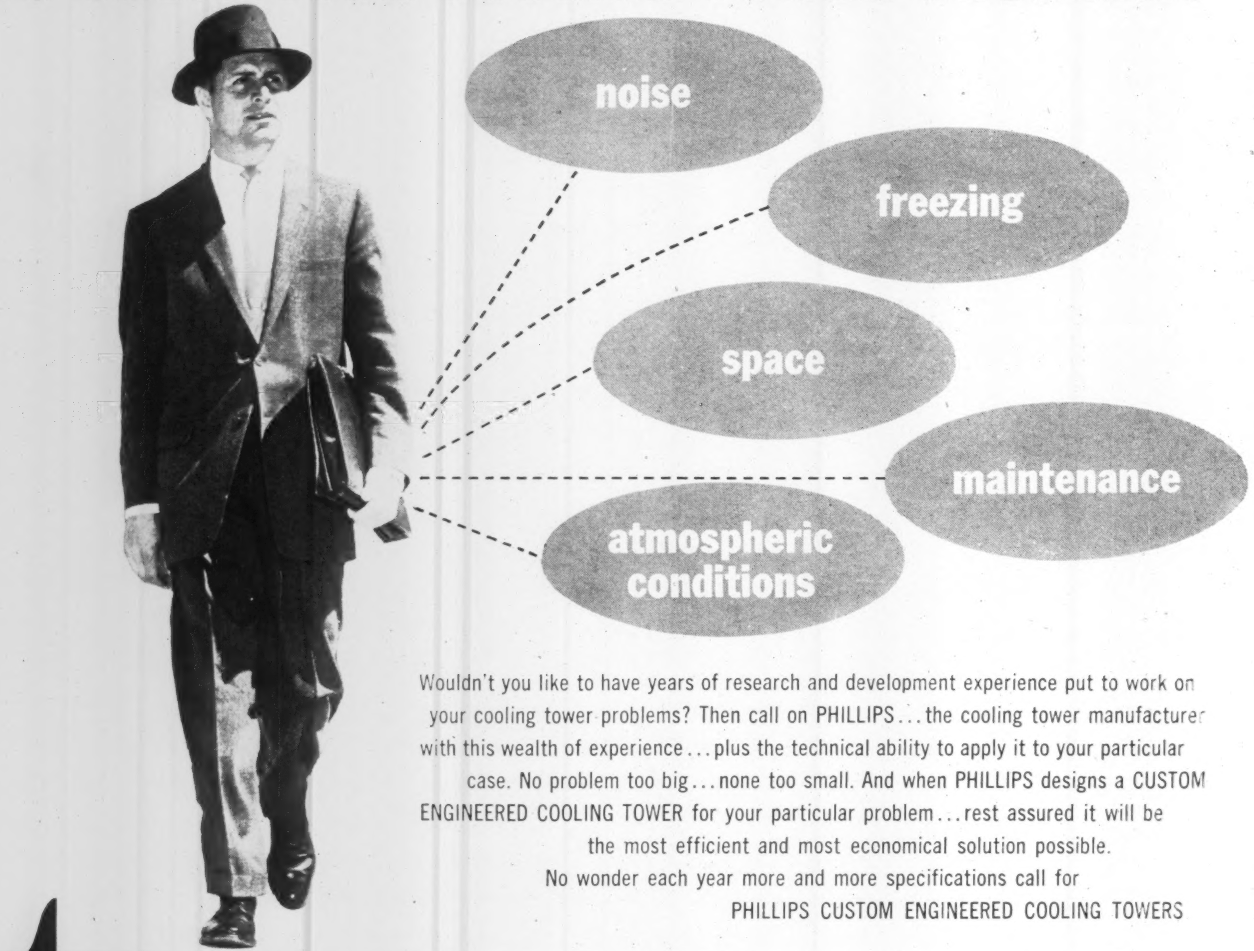
"With our boilers sized for a winter load, we were naturally oversized for the summer months. But York's gas-operated Lithium Bromide absorption water chillers permit us to make efficient use of part of this steam capacity to cool," says Mr. M. J. Mather, President of the Allen Manufacturing Company, makers of hex-socket screws.

The York Lithium Bromide system eliminates the need for huge compressors found in other types of cooling equipment . . . which brings down the original cost considerably. And with gas the boiler fuel, you make year-round use of an otherwise wasted source of power *at rock bottom costs.* In addition, York machines are noiseless, lightweight, compact—easy to install and readily adaptable to almost any plant layout.

Find out how your present heating system can pay off for you all year 'round with gas-operated York automatic water chilling units. Call your local gas company or write to the York Corporation, Subsidiary of Borg-Warner Corporation, York, Pennsylvania. *American Gas Association.*

CALL ON Phillips CUSTOM ENGINEERING

TO SOLVE YOUR COOLING TOWER PROBLEMS



Wouldn't you like to have years of research and development experience put to work on your cooling tower problems? Then call on PHILLIPS... the cooling tower manufacturer with this wealth of experience... plus the technical ability to apply it to your particular case. No problem too big... none too small. And when PHILLIPS designs a CUSTOM ENGINEERED COOLING TOWER for your particular problem... rest assured it will be the most efficient and most economical solution possible.

No wonder each year more and more specifications call for PHILLIPS CUSTOM ENGINEERED COOLING TOWERS

EVERY STEP CUSTOM ENGINEERED

CASINGS
Selection of material to fit Architectural treatment and surrounding conditions.

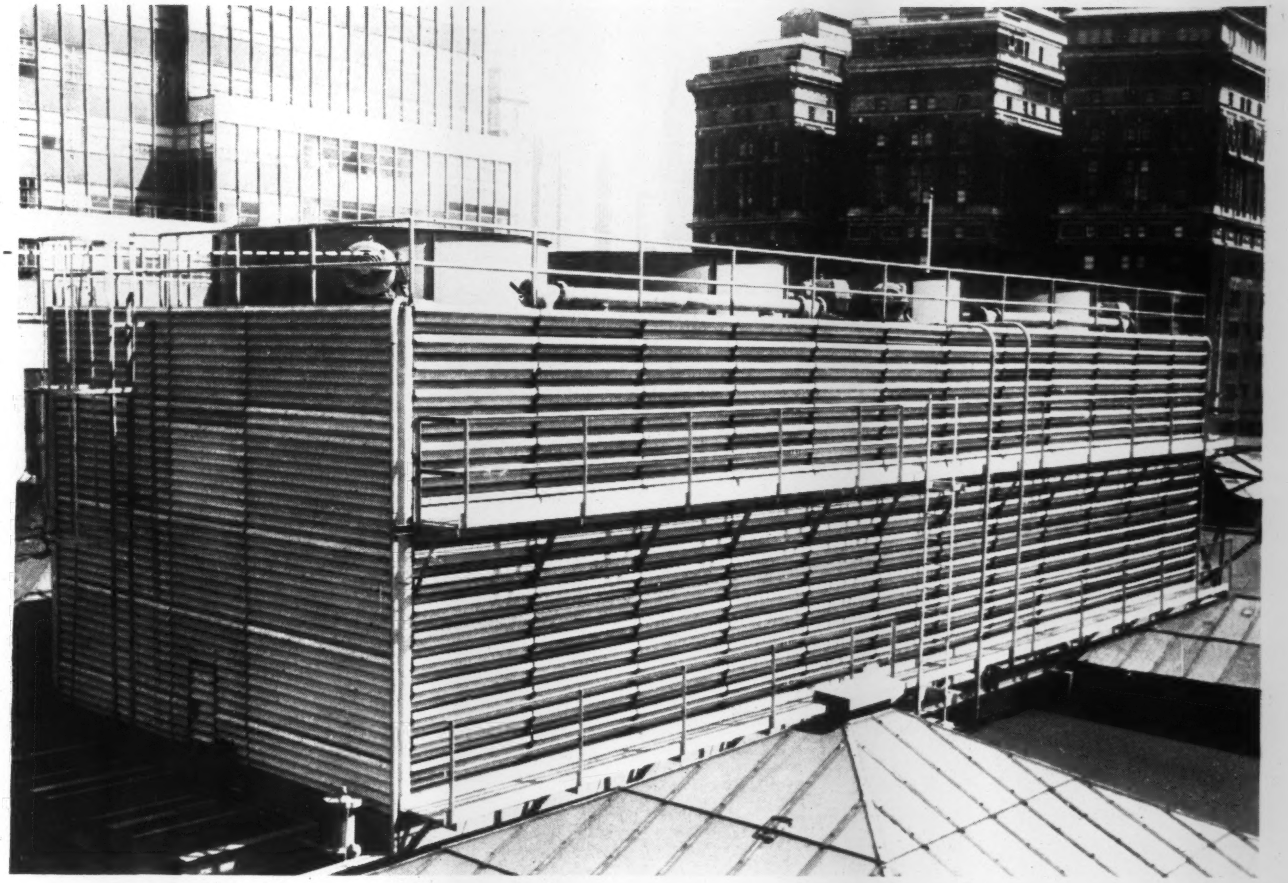
BASINS
Redwood, stainless steel, galvanized steel, carbon steel up to and including ¼" thickness with any desired coating, reinforced concrete basins supported on steel beams.

DISTRIBUTION SYSTEM
Spray nozzle type or open Weir gravitational type system.

FANS
Multi-blade, adjustable propeller type fan in cast aluminum, stainless steel or Monel. Either direct driven fan in small sizes or indirect right angle worm gear drives.

FILL
Redwood or pressure treated Douglas Fir. Slip-fit, self-supporting for easy removal for interior maintenance.

FRAMEWORK
Hot dipped galvanized structural steel .250" minimum thickness. Redwood or pressure treated Douglas Fir.



GIMBEL'S DEPARTMENT STORE, New York City
Consulting Engineer: Charles S. Leopold, Philadelphia, Pa.

another problem solved by Phillips

CUSTOM ENGINEERED COOLING TOWERS

the problem:

To provide a cooling tower as free from maintenance as possible and yet perform efficiently in the limited area.

the solution:

PHILLIPS CUSTOM ENGINEERED COOLING TOWER with "Dual-Airstream" design, modified to provide accessibility under fill. Hot dipped galvanized framework field-coated with butyl rubber to further improve service life. Walkways provided at two levels for easy inspection and maintenance.

result:

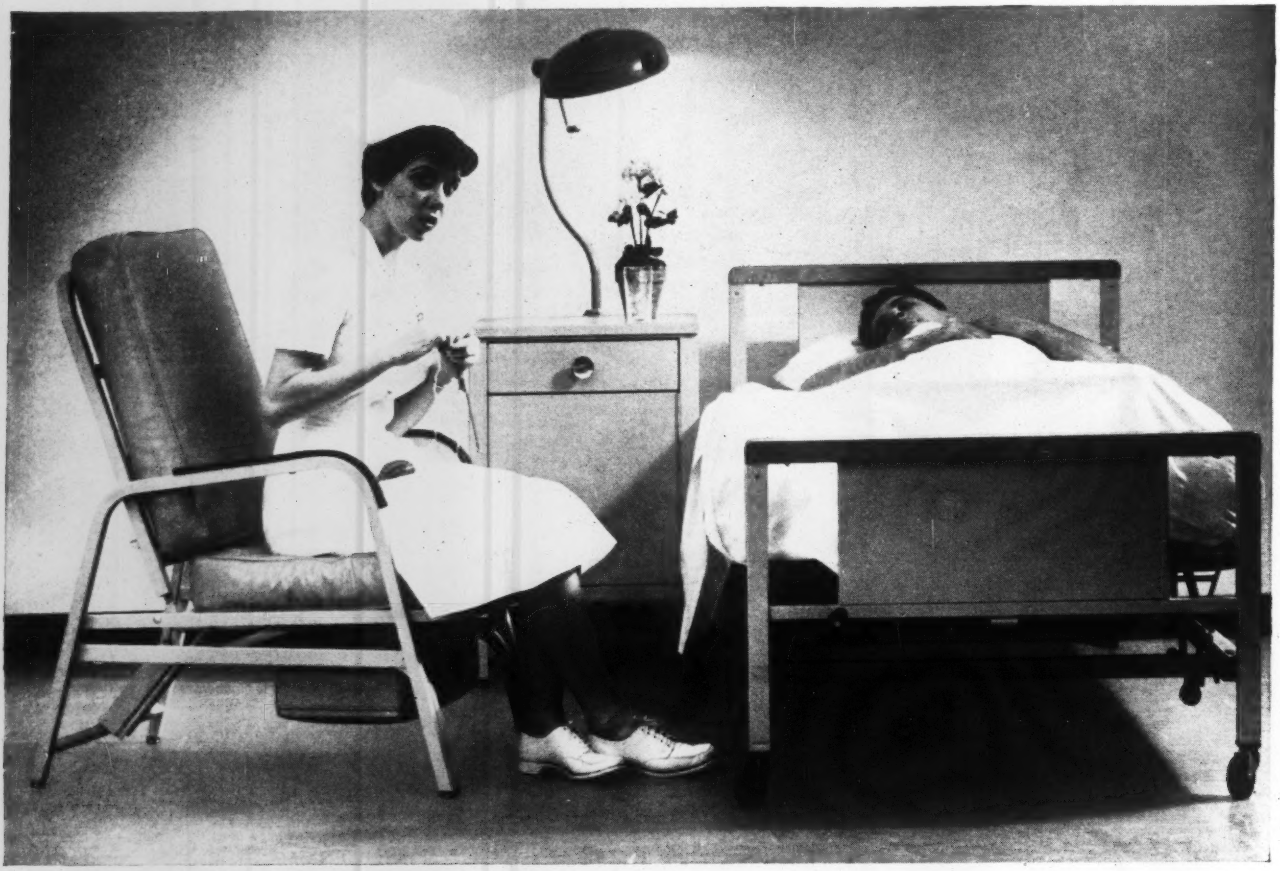
A trouble-free cooling tower that provides maximum efficiency for one of the world's largest department stores.

SPECIAL FEATURES ON ALL TOWERS

Corrosion Resistant Hardware. Aluminum or Stainless Steel Fans. Nailless Redwood Filling Removable at Tower Base. Nailless Three-Pass Redwood Eliminators. Removable Louvers.

WRITE FOR LITERATURE

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.

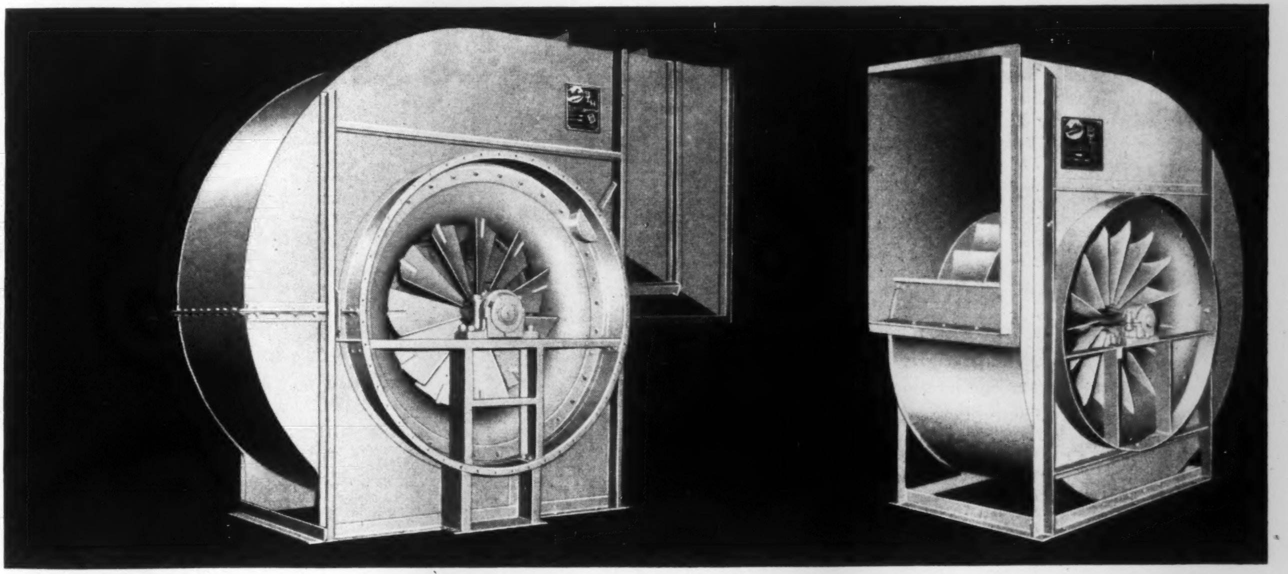


So quiet you could hear his temperature drop!

Stretching a point? To be sure, but only because falling temperatures don't make much noise. Fact of the matter is, with "Buffalo" fans serving our imaginary hospital, you could **hear just** about anything, or nothing, the fan noise level is so low. This is only one of the reasons you should insist on "Buffalo" fans for your ventilating-air conditioning systems. If you would like to know more, read the opposite page.

THE "BUFFALO" TYPE "BHL" FAN FOR HIGH PRESSURE

THE "BUFFALO" TYPE "BL" FAN FOR MODERATE PRESSURE



For your high pressure systems (Class III and IV) "Buffalo" offers their Type "BLH" Fan. This fan also has an exceptionally low noise level while offering high mechanical efficiencies over a broad operating range. Peak mechanical efficiency is 86%.

In addition to the aforementioned "BL" design features, the type "BLH" has a divergent outlet to minimize cut-off turbulence. This divergent outlet not only insures smooth air flow and high static regain, it provides even pressure distribution at the outlet.

Famous "Buffalo" "Q" Factor quality construction is used throughout providing a long life of low-maintenance, trouble-free service. For your conduit air conditioning and other high pressure jobs, the specially designed "Buffalo" Type "BLH" has more to offer than any other suitable fan.

Here's a highly refined fan design suitable for your general air moving jobs. Low noise level is but one of the advantages of this design. Another is high efficiency, particularly important as horsepower requirements rise. A third consideration might be the minimum amount of maintenance necessary with the "Buffalo" type "BL" fan.

These and other desirable benefits are the result of a fan design offering an inlet bell and wheel shroud forming a true half-circle for smooth air entry. Cantilevered inlet vanes permitting low turbulence air conditions. And backward curved wheel blades with non-overloading characteristics.

This tells but a fraction of the story. If you want to be really sure of the fans on your next moderate pressure job, see that they are "Buffalo" Type "BL's".

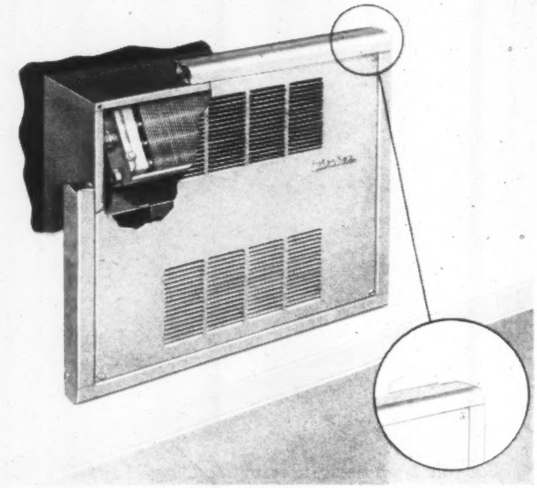
Additional information on these and other "Buffalo" Fans can be obtained from your nearest "Buffalo" Engineering Representative. Or write us direct if you wish. Your letter will receive our prompt attention.

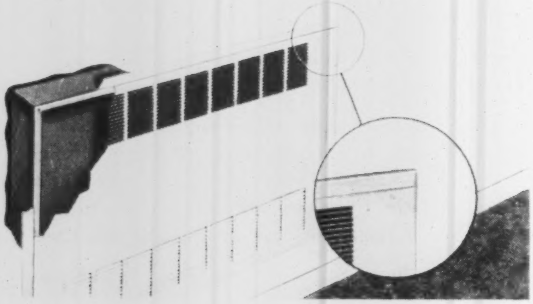
BUFFALO FORGE COMPANY "Buffalo"
Buffalo, N. Y.
Buffalo Pumps Division, Buffalo, N.Y.
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING • AIR CLEANING • AIR TEMPERING • INDUCED DRAFT • EXHAUSTING • FORCED DRAFT • COOLING • HEATING • PRESSURE BLOWING

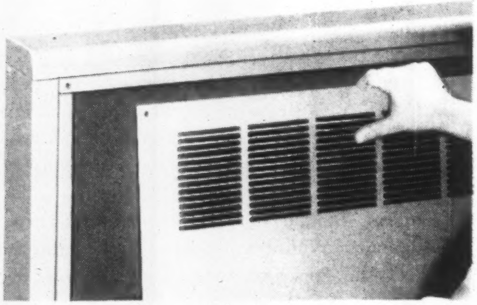
Modine ends the recessing cabinet

Modine Cabinet Unit for heating-ventilating is partially recessed in a finished wall. Recess edge concealed with Perma-lap. Inset shows Perma-lap serving as a plaster stop on partially recessed style. Permanent bond between Perma-lap and plaster remains unbroken when front is removed.





Fully recessed convector permanently and neatly installed flush with ⅝" Perma-lap serving as a plaster stop. Plaster and Perma-lap form a sealed bond — no chance for air leakage. Inset shows Perma-lap installed with only ⅛" projecting beyond finished wall.



Partially recessed convector with 2⅜" Perma-lap. Notice how front panel can be removed without marring paint or plaster, unlike conventional enclosures where entire casing front is taken off whenever servicing is necessary.

For more information, call the Modine representative listed in your classified phone book. Ask for Catalog on convectors or cabinet units, or write Modine Mfg. Co., 1500 DeKoven Ave., Racine, Wis.

muss and fuss of units, convectors

Installations are faster, easier and neater with Modine's new Perma-lap framing method

---

Here's a big step forward . . . a better way to install recessed units with less labor.

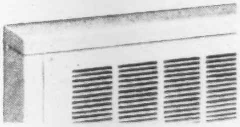
Perma-lap neatly frames Modine units to end unsightly air leakage and wall streaking. Even on rough walls Perma-lap assures a neat, permanent installation. With framing, units can be serviced without disturbing the wall seal. The front can be removed time after time without cracking plaster or chipping paint.

By using Modine Perma-lap, recessed installations need less supervision. Even inexperienced workmen can do the job right.

Take advantage of Modine's labor-saving and attractive Perma-lap design. Use Modine cabinet units or convectors on your next heating job.

PREVENTS WALL STREAKING

Rough wall or smooth, there's no wall streaking due to air leakage. Modine's exclusive Perma-lap framing snugs up to finished walls or can be plastered in.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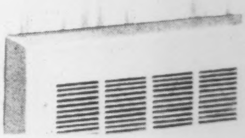
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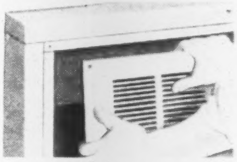
PRESERVES PAINT OR PLASTER BOND

Perma-lap lets you remove the enclosure front without cracking plaster or chipping wall paint. Perma-lap stays in place . . . always neat.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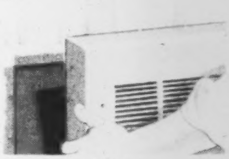
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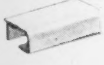
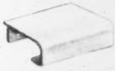
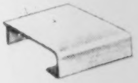
CHOICE OF 4 FRONT PROJECTIONS

Perma-lap is made to accommodate variations in recess depth. Four projection depths . . . ⅜", 2⅜", 4⅜", 6⅜"

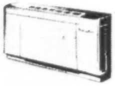
⅜"

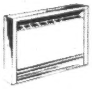

2⅜"


4⅜"


6⅜"

RC-1369

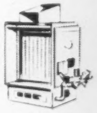

AIRditioners


Convectors

Cabinet units

Gas unit heaters

Steam & hot water unit heaters


Duct furnaces

In Canada: Sarco, Ltd., Toronto

Modine
MANUFACTURING COMPANY

Pittsburgh Superfine is quickly cut to correct size with a knife. Cut sections are then bonded to duct with adhesive. Extra adhesive is applied to edges of insulation to adhere them to edges of metal.

"We used one-inch, 1½-lb. density Pittsburgh Superfine Fiber Glass Insulation with a Neoprene coating to line all ducts," says Mr. George P. Fenton. "Superfine is flexible, adaptable and easy to handle."

At Greater Pittsburgh Airport's New Extension— Pittsburgh Superfine Insulates Air Conditioning Duct Work

"When our company installed the sheet metal ducts for the two air conditioning systems at Greater Pittsburgh Airport's new East Dock, we used over 7,000 sq. ft. of Pittsburgh Superfine Fiber Glass Insulation as the acoustical and thermal lining for the ducts," reports Mr. George P. Fenton, General Manager, McIlroy Sheet Metal Engineers and Fabricators, Pittsburgh, Pennsylvania.

Why Pittsburgh Superfine was specified

"This job called for an insulation that could withstand air velocities, would have proven erosion resistance, would provide good acoustical properties at minimum cost, and would insure resistance against temperature differential. Pittsburgh Superfine met all these requirements easily."

Easy to work with on the job

"We've used Pittsburgh Superfine often, and know from experience that it's flexible, adaptable, easy to handle and easy to cut. It's especially adaptable for use in irregularly curved ducts. There was not a single installation problem on the airport job that we could not handle with Superfine," concluded Mr. Fenton.

Pittsburgh Superfine Fiber Glass can help you, too!

It's rot proof, fire-resistant . . . and it's the finest insulation against heat, cold or noise you can get! Available in a variety of facings to meet your needs. For complete information, write to *Pittsburgh Plate Glass Company, Fiber Glass Division, One Gateway Center, Pittsburgh 22, Pa.*

PITTSBURGH SUPERFINE IS A PRODUCT OF THE FIBER GLASS DIVISION OF PITTSBURGH PLATE GLASS COMPANY

Sales offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

FIBER PPG GLASS **PITTSBURGH PLATE GLASS COMPANY**

Honeywell announces a major scientific breakthrough---the **ULTRAVIOLET SENSOR**

NEW FLAME SENSOR POSITIVELY DIFFERENTIATES BETWEEN FLAME AND HOT BRICK

Honeywell development utilizes invisible ultraviolet rays to revolutionize safety standards in detection devices.

Honeywell's New Ultra-Vision* Flame Detector, C7012A

*Trademark

An ultraviolet-sensitive tube about the size of an index finger now solves all your flame sensing problems, including refractory override and hold-in.

Developed by Honeywell, the C7012A Ultra-Vision tube is the only sensor that can tell the difference between real flame and red-hot firebrick so that raw fuel delivery is stopped immediately in the absence of flame. It also eliminates nuisance shutdowns occurring when refractory glare masks out the flame.

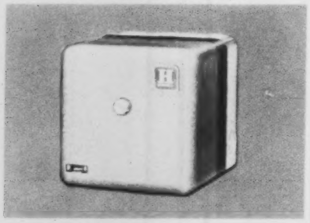
Multiple-burner installations are greatly simplified since the Ultra-Vision tube, being insensitive to the refractory, can be aimed directly at the flame in any convenient way—the sensor will detect a flame from any type of fuel.

The C7012A ultraviolet sensor will bring revolutionary new safety to gas and oil burners. For complete information call your local Honeywell office, or write Honeywell, Minneapolis 8, Minnesota.

The Ultra-Vision Flame Detector will work with all Honeywell rectification relays →

MATCH YOUR JOB REQUIREMENTS WITH THE MOST COMPLETE LINE OF BURNER CONTROLS IN THE INDUSTRY

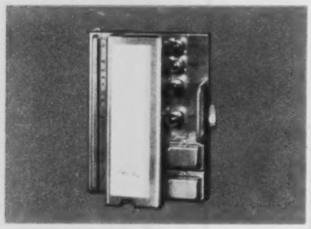
New U.L. requirements mean stack relays can no longer be used on commercial burners of more than seven-gallon size. You can meet *all* requirements by choosing Honeywell, now offering the most complete line of Electronic Combustion Controls with exclusive Safety Start.



FOR MEDIUM BURNERS—RA890C PROTECTORELAY*

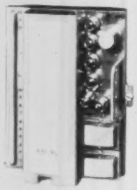
The RA890C is a basic rectification relay ideally suited for use with the new C7012A Ultra-Vision sensor, as well as with flame rods or photocells. It's designed especially for pressure-gun oil burners, small combination gas-oil burners and gas power burners.

*Trademark



FOR LARGE CONVERSION BURNERS—R478 PROTECTORELAY

Here's an electronic programming relay for large horizontal rotaries, combination gas-oil burners, steam-atomizing burners and large power gas burners. The R478A may be used with the C7012A Ultra-Vision sensor, flame rods or photocells. The R478B is available for use with lead-sulphide cells.



FOR MEDIUM-SIZE COMMERCIAL BURNERS—R4074B PROTECTORELAY

In applications where the extra flexibility of the R478 (above) is not a requirement, the R4074B Protectorelay provides an economical programming relay for use with lead-sulphide flame detection systems.

Choose Honeywell—all types of controls for every possible combination!

• Choice of flame detection • Choice of burner sequencing • Manual or automatic starting
• Wide range of voltages • Fast detection and response • Ease of installation
• Low maintenance costs • Honeywell nationwide engineering and service

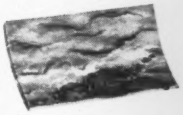
FOR MORE DETAILS, call your local Honeywell office—or write Minneapolis-Honeywell, Minneapolis 8, Minn.

Honeywell

H HONEYWELL *First in Control*

76-4786 Printed in U.S.A.

With no lining at all

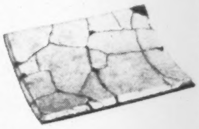


Unlined steel heaters are subject to corrosion even under normal service.

With plastic lining

There is no known plastic or phenolic lining that will withstand temperatures required for hot water service.

With ordinary concrete lining



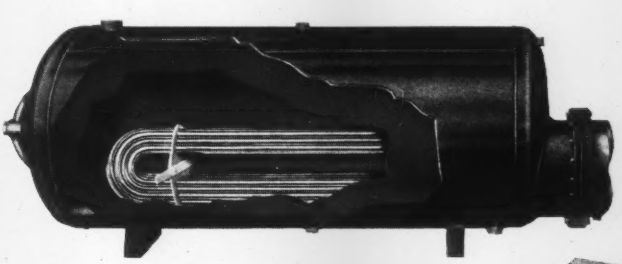
Plain steel plates soon lose protection, due to cracking and chipping. Cracks create localized corrosive cell spots.

SPECIFY the only cement lining made exclusively for Storage Water Heaters...

P-K PRE-KRETE®

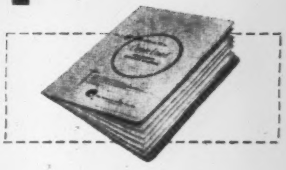
Every cement-lined storage water heater bearing the P-K name-plate is factory-lined with Pre-Krete. Pre-Krete is completely uniform, without weak spots or "holidays," because it is thoroughly blended in special P-K equipment. It forms a strong, durable coating, ¾″ thick, that prevents rust and corrosion, and provides high resistance to thermal shock. Pre-Krete will not chip, crack, or flake even at temperatures up to 900°F.

You get a comprehensive guarantee on every P-K Storage Water Heater



Every P-K Pre-Krete Lined Storage Water Heater is fully lined including manhole, cover plate and heating element nozzle.

Specify P-K Pre-Krete lined and you get a storage water heater on which all materials and workmanship are fully guaranteed to be first-class in every respect, and you have the P-K assurance that every heater bearing its name will heat its rated capacity of water. For full details, write for your copy of Catalog Number 19 to Patterson-Kelley, 2105 Linton Street, East Stroudsburg, Pennsylvania.



2

Patterson Kelley
Water Heater Division

storage water heaters • instantaneous heaters • convertors • water to water exchangers

easy to handle!
UNION CARBIDE
Ucon
fluorocarbons

Easy and Safe to Carry

Ring-top provides a solid, generous hand-hold—more than 4" to grip, reducing risk of cylinder damage or personal danger. No more hunting for separate carrying devices!

new ring-top cylinders

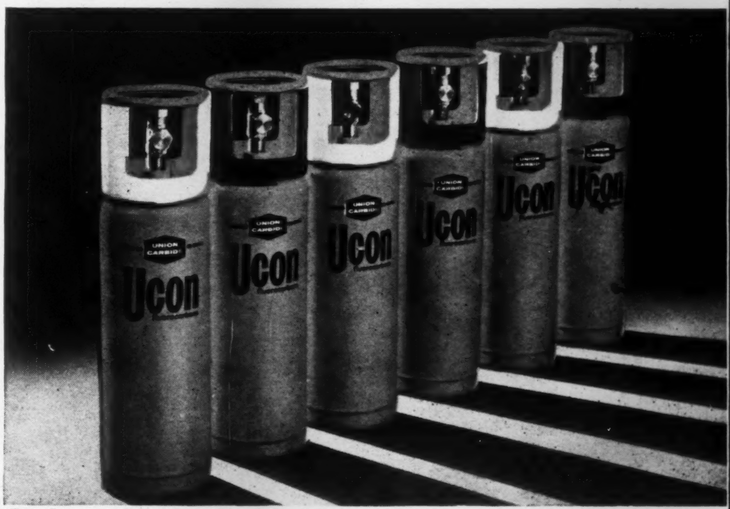
exclusive with Ucon BRAND refrigerants

Ucon Refrigerants 12, 22 and 114 Are Now Available in 10 and 25 Pound Ring-Top Cylinders for Easy Handling . . . Fast, Convenient Inventory!

Ucon
UNION CARBIDE

Makes Service Jobs Easier

Inverted cylinder stands alone. Any standard wrench operates valve. Install flexible tubing and forget it until cylinder is empty.



Color-Coded at the Top

Big colored top section makes it easy to check your stock of Ucon Refrigerant grades . . . at a glance. No cylinder caps to keep track of.

Made in Five Top-Quality Grades, Ucon Refrigerants 11-12-22-113-114 meet your strictest standards for dryness, purity and economy.

Full Choice of Unit Sizes to match *your* quantity needs. Ucon Refrigerants are sold in 10 and 25 pound Ring-Top Cylinders, in 145 pound and ton cylinders, in 100 and 200 pound drums, and in tank-wagon or tank-car lots.

Prompt, Efficient Delivery from the largest network of distribution points in America serving the refrigeration and air conditioning industries.

Get Full Data on Ucon Refrigerants now! See your wholesaler, or write: Ucon Refrigerants, Union Carbide Chemicals Company, 30 East 42nd Street, New York 17, N. Y. Call, write or wire us, any time. Attention, Dept. F-5.

Ucon and Union Carbide are registered trade marks of Union Carbide Corporation.

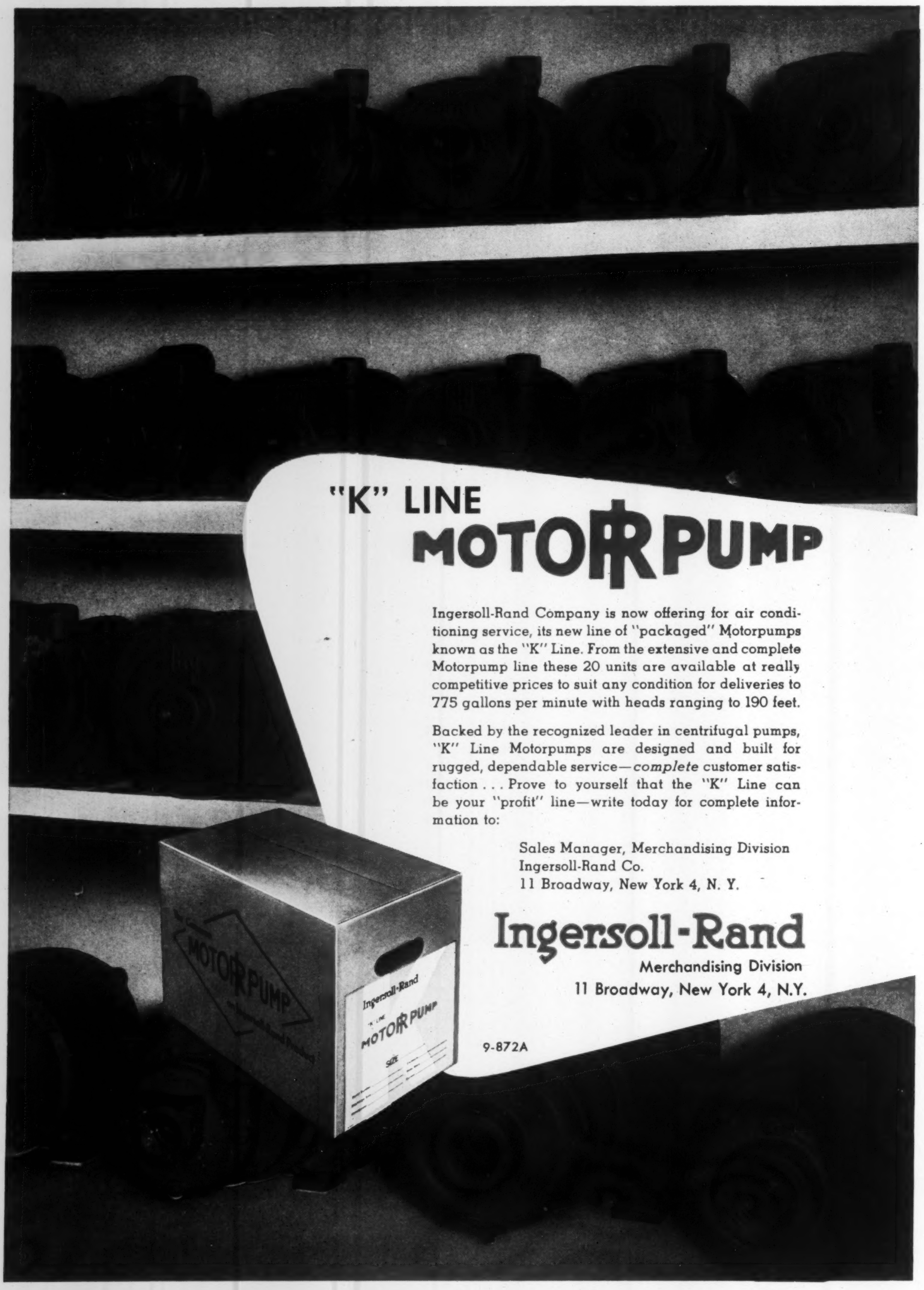
UNION CARBIDE
Ucon
BRAND
refrigerants

These 5 Ucon Brand Refrigerants will meet your refrigeration and air conditioning needs

Ucon Refrigerant 11 Trichloromonofluoromethane
Ucon Refrigerant 12 Dichlorodifluoromethane
Ucon Refrigerant 22 Monochlorodifluoromethane
Ucon Refrigerant 113 Trichlorotrifluoroethane
Ucon Refrigerant 114 Dichlorotetrafluoroethane

UNION CARBIDE CHEMICALS COMPANY

Division of Union Carbide Corporation



"K" LINE
MOTOR PUMP

Ingersoll-Rand Company is now offering for air conditioning service, its new line of "packaged" Motorpumps known as the "K" Line. From the extensive and complete Motorpump line these 20 units are available at really competitive prices to suit any condition for deliveries to 775 gallons per minute with heads ranging to 190 feet.

Backed by the recognized leader in centrifugal pumps, "K" Line Motorpumps are designed and built for rugged, dependable service—*complete* customer satisfaction . . . Prove to yourself that the "K" Line can be your "profit" line—write today for complete information to:

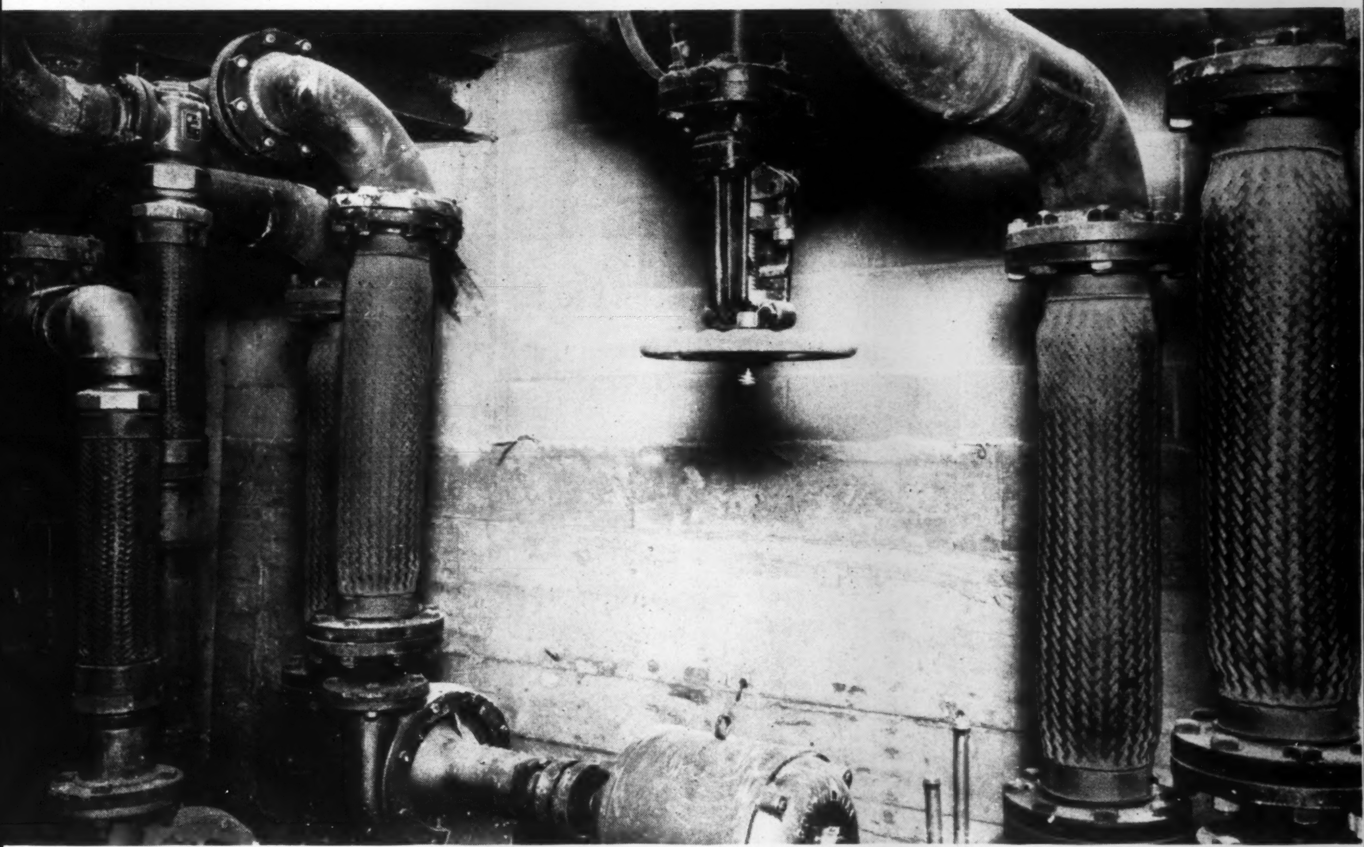
Sales Manager, Merchandising Division
Ingersoll-Rand Co.
11 Broadway, New York 4, N. Y.

Ingersoll-Rand
Merchandising Division
11 Broadway, New York 4, N.Y.

9-872A

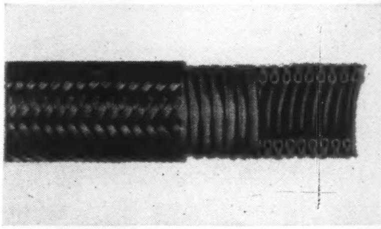
APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe®



Four 5-inch Flexpipe Connectors 30" long and four 3-inch Flexpipe Connectors 18" long connect pumps with hot water heating mains in big new Detroit Lakes, Minnesota, Senior High School. Architects: Traynor & Hermanson, St. Cloud, Minn. Engineers: Gausman & Moore Inc., St. Paul. Mechanical contractors: Holm Brothers, Atwater, Minn.

Flexpipe connectors handle expansion on long horizontal runs in big hot water job—eliminate vibration from pumps



FLEXPIPE'S flexible core can be either tin bronze, hot-dipped galvanized steel or stainless steel. End fittings (attached): flanges, threaded males and welding nipples.

The multi-structure design of many modern schools and institutions often makes necessary long horizontal runs for the heating mains. In hot water systems, it is very desirable, if not essential, to prevent transmission of vibration from the pumps to the mains. Flexpipe flexible connectors are designed for this service—will reduce pump vibration and noise.

Flexpipe connectors at the same time take up expansion and contraction in the mains. Thus in many cases they eliminate the need for expansion bends — make possible smaller, more economical tunnels—simplify and speed installation, reduce maintenance.

WHERE TO BUY: Flexpipe connectors come in convenient standard sizes, are sold by leading distributors. For the name and address of the one serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario.

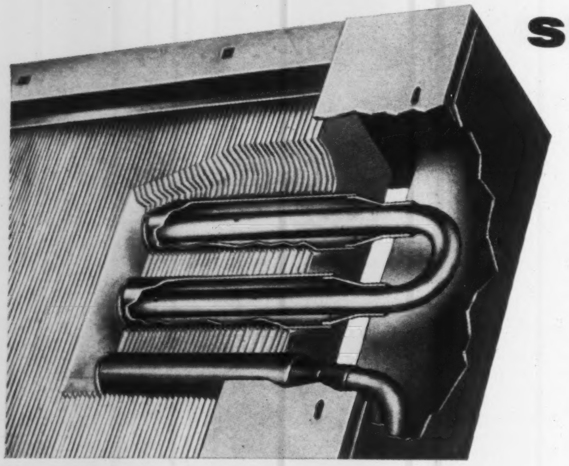
58227 Rev.

Flexpipe® an ANACONDA® product

NO "FAHRENHEIT FADEOUT"

with Nesbitt

SERIES T SURFACE

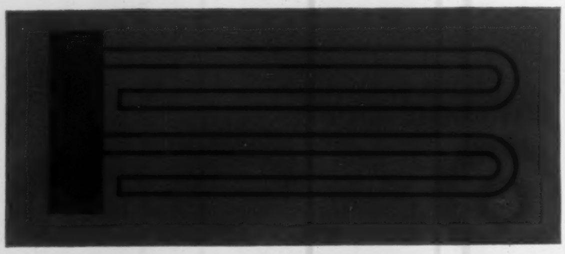


Exclusive Trombone Design provides uniform discharge temperature and maximum freeze protection

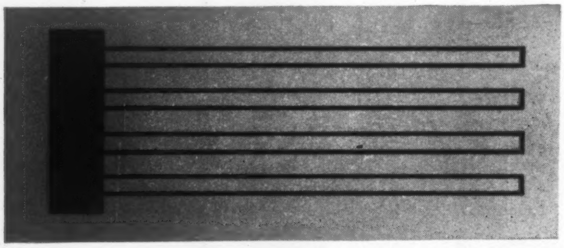
Nesbitt Series T Heating Surface employs a unique principle by which you can achieve uniformity of steam distribution unmatched by conventional arrangements. It is ideally suited to applications requiring direct preheating of outdoor air, or where uniform discharge temperature under throttled control is important.

The trombone-like design delivers steam continuously to adjacent pairs of condensing tubes—doubles the area over which small steam quantities are distributed . . . prevents freeze-up.

Get complete details on capacities and application data now. Write for Nesbitt Publication 305-1.



In Series T design, steam traverses full length of tube, even under modulated conditions. This design prevents "back up" or heat fadeout. Note single connection to supply header for each pair of tubes.



In conventional arrangements, the same steam quantity under throttled control travels only half as far along surface length. Steam fades out toward end of tubes. And there are twice as many connections to the supply header.

Nesbitt

HEATING SURFACE WITH THE TROMBONE **STEAM DISTRIBUTING TUBES**

Made and sold by John J. Nesbitt, Inc., Phila. 36, Pa.

IT MAKES SENSE !

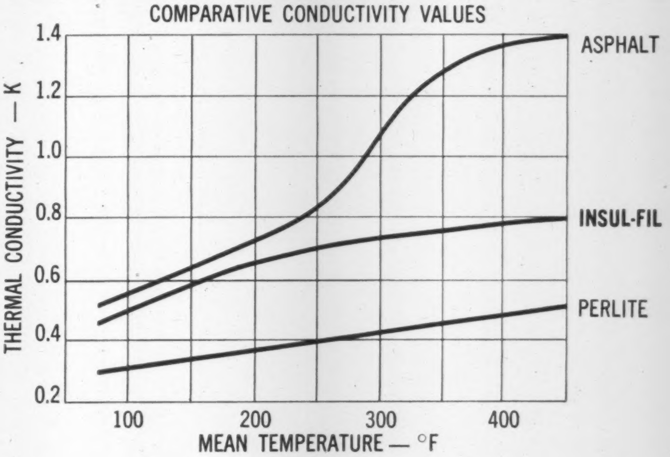
TO INSULATE UNDERGROUND PIPING WITH

insul-fil®

1 Introduction of a material such as expanded perlite into a granulated hard asphalt improves the insulating value of the blend.

2 Proper selection of asphalts by softening point to make up asphalt-perlite blends improves the insulating properties of the blend.

3 Introduction of an aggregate, such as perlite, into a granulated asphalt improves the mechanical properties of the blend once it is plasticized.



After years of extensive testing conducted at the Research and Development Department of The Atlantic Refining Company, these conclusions were presented in a Paper given before the American Chemical Society in Dallas, Texas, April, 1956. Since that time, hundreds of Insul-fil field installations have confirmed these conclusions.*

It is a well-known fact that the use of asphalt in construction created the necessity for the introduction of fillers (usually inorganic) of various types for the purpose of arresting the flow characteristics and improving the insulation value of the asphalts themselves.

The blend of hard granular asphalt and asphalt coated perlite gives Insul-fil its excellent insulating properties, water resistance and sufficient structural strength to the insulating body to resist normal soil stresses with the steam on or off.

An important Insul-fil development is the priming of the pipe with Accelerator #7591. The use of accelerator provides continuous adhesion of Insul-fil to the pipe, hastens consolidation, and gives additional protection against corrosion by galvanic action.

**Paper available on request.*

Insul-fil Is Simple To Install

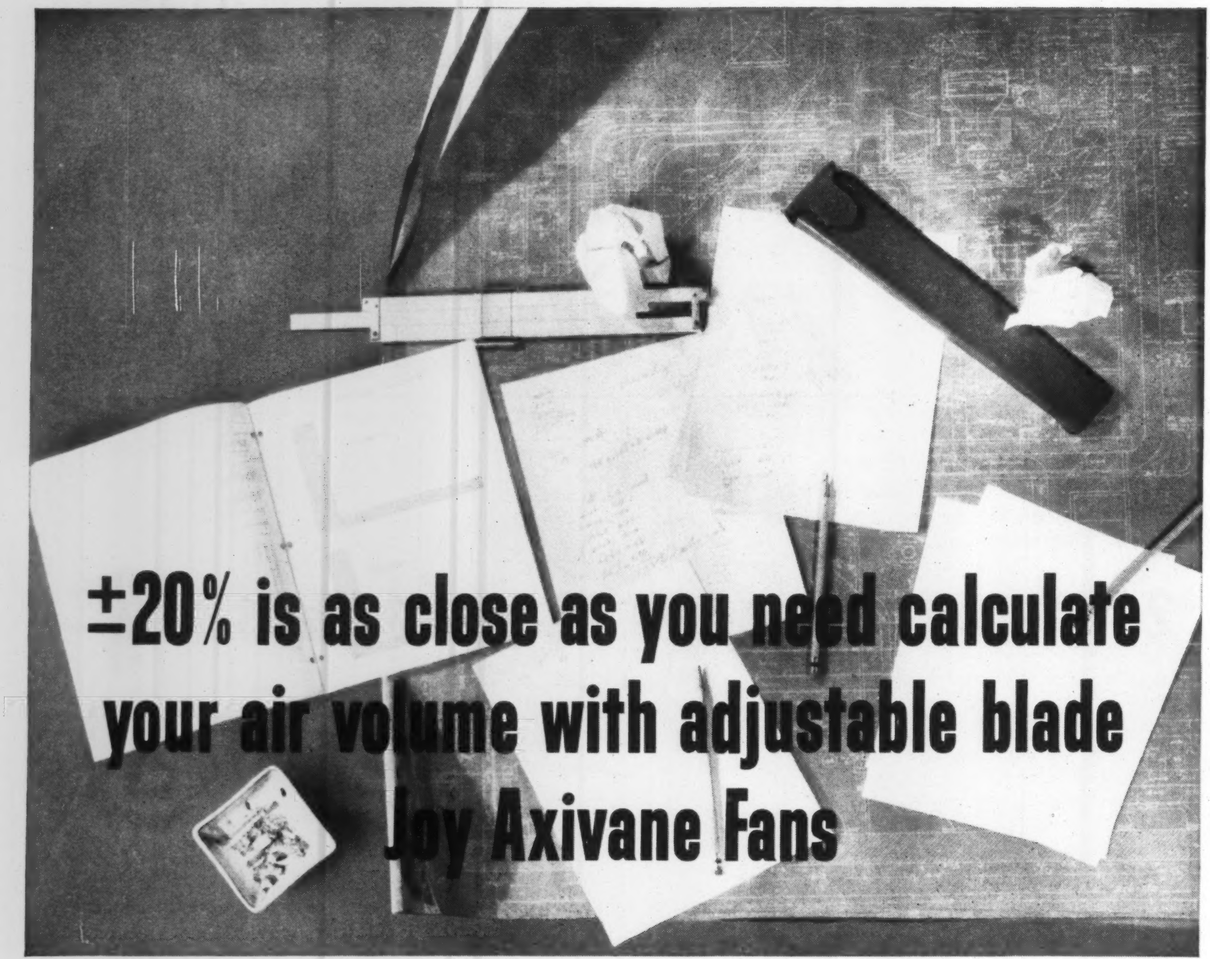
Just pour it around the pipe to be insulated. Prod and tamp it in place and backfill. Heat introduced into the pipe forms the conduit.

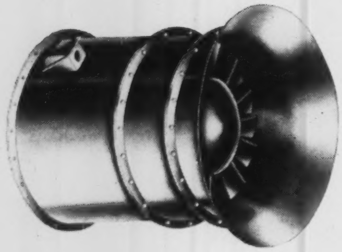
Insul-Fil Company Inc.
250 Pettit Avenue
Bellmore, Long Island, N. Y.
Please send literature.

NAME____________________
COMPANY____________________
ADDRESS____________________
CITY__________ ZONE____ STATE________

insul-fil ***The most efficient Granular Fill Type Insulation for Hot Underground Piping***

Insul-Fil Company Inc. DIVISION OF: MIRACLE ADHESIVES CORPORATION, 250 PETTIT AVENUE, BELLMORE, LONG ISLAND, N. Y.


±20% is as close as you need calculate
your air volume with adjustable blade
Joy Axivane Fans



Computation of air volumes required for ventilation can be greatly simplified by installing Joy Axivane Fans. Standard models are furnished with adjustable blades which can be rotated to change pitch, and consequently volume, over a considerable range. This permits compensating for circumstances unforeseen when air requirements were computed, and also allows the installation of fans which will be able to efficiently supply additional air for pre-planned expansions of the plant. Blade adjustments can be made by anyone in a matter of minutes. Calibrated scales on hub and blades assure accurate matching of blade pitches.

Joy Axivane Fans are designed with integral motors to permit in-duct installation. This reduces installation costs, and saves space. The fans are available in a wide range of sizes for every type of duty, and can be furnished in special materials for use in corrosive atmospheres.

Whatever your fan requirements may be, Joy has the answer.

Ask for Bulletin 290-41.

WSW I 7483-290

JOY

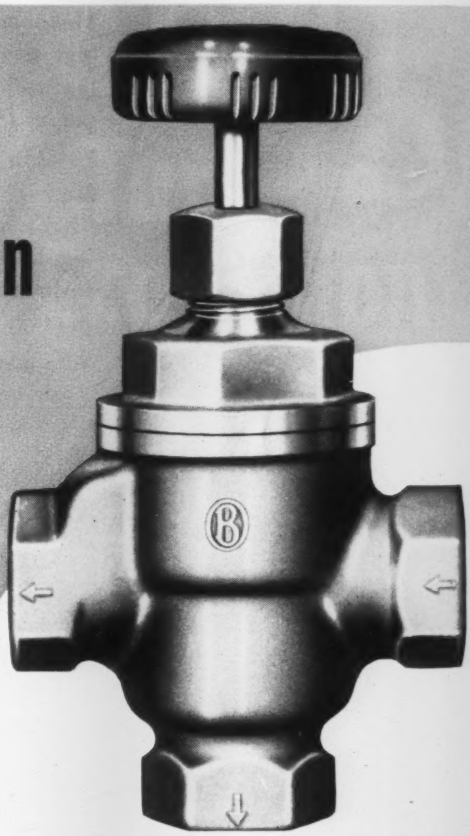
AIR MOVING EQUIPMENT FOR ALL INDUSTRY

Dust Collectors | Compressors | Ready-Span Conveyor | Fans and Blowers

Joy Manufacturing Company
Oliver Building, Pittsburgh 22, Pa.

In Canada: Joy Manufacturing Company
(Canada) Limited, Galt, Ontario

Use this O-B Valve Combination

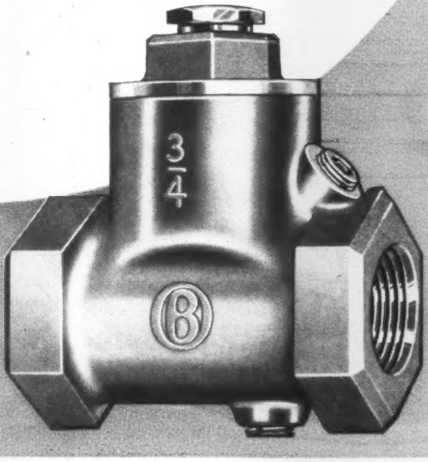


... for
complete balancing
... for individual
temperature control in
Central Air Conditioning
and Heating

Here's the modern way to use valves to regulate operation of a central air conditioning or heating system.

For balancing use O-B Equatemp®, available with either threaded or solder-type pipe ends. It balances and shuts off and can be used for purging. Thus it does a job that formerly required two or more valves or fittings.

Solder end valves (No. 3700) can be furnished in 3/8, 1/2 and 3/4-inch sizes. Threaded end valves (No. 3800) are available in 1/2 through 1 1/2-inch sizes.



For separate control of individual units, use the No. 4600, O-B's new low-cost three-way valve. Its parallel, double-seat construction enables occupants of each room to regulate temperature to fit their individual comfort, without affecting other units in the system.

Regardless of the position of the three-way valve, the quantity of water pumped through the system does not change. This means pump delivery remains constant. Danger of overloading pump motors is virtually eliminated.

The 4600 is available with either threaded, or solder-type pipe ends. Use it with the O-B Equatemp to get an easily balanced, closely controlled system at a low price.

Available in 3/8 and 1/2-inch sizes only.

Ohio Brass

MANSFIELD OHIO, U.S.A.

4848-VR

These pumps are designed especially for handling high temperature liquids. The following description will help you evaluate the suitability of these pumps for this specialized service.

In addition to these special features, "Buffalo" High Temperature Pumps bring you the famous "Buffalo" hydraulically efficient impeller and casing design. Accessibility, dependability and long, maintenance-free life are important *extra* values in every "Buffalo" Pump.

Whatever your heat transfer problem — including vapor phase — phone your "Buffalo" engineering representative for full information.

Only "Buffalo" Pumps bring you the famous "Q" Factor — the built-in QUALITY that provides trouble-free satisfaction and long life.

BUFFALO PUMPS

Division of Buffalo Forge Co.

171 Mortimer St., Buffalo, N. Y.

Canada Pumps, Ltd., Kitchener, Ont.
Sales Representatives in all
Principal Cities

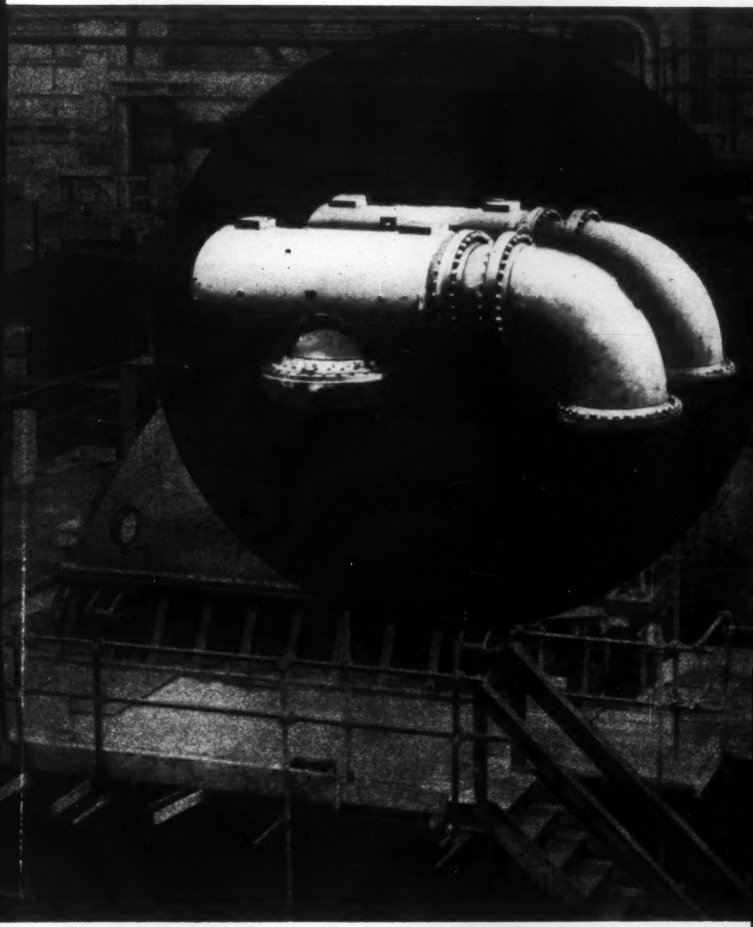
SPECIAL FEATURES OF BUFFALO HEAT TRANSFER PUMPS

- Cast Steel Casings and Side Plates with Full Centerline Support
- Water Cooled Bearings and Stuffing Boxes
- Special Packing. Mechanical Seals are Available.
- Smothering Gland.
- Flexible All-Steel Coupling
- Colmonoy-Coated Shaft Sleeve Thru Stuffing Box.

FOR MOVING HEAT TRANSFER LIQUIDS...

RELY ON "BUFFALO" HIGH TEMPERATURE PUMPS

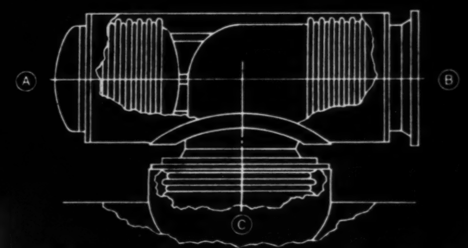
BUFFALO PUMPS
A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID



GIANT Turbine Expansion Joints Built by BADGER

Photo shows 150,000 kw steam turbine-generator unit undergoing tests prior to shipment at General Electric's Turbine-Generator Plant in Schenectady, N. Y. Badger Expansion Assembly is clearly visible atop turbine.

Badger balanced elbow expansion assembly.



Joint A balances thrust due to internal pressure of 65-150 psi; joint B absorbs axial movement; joint C absorbs the differential expansion between the inner and outer casings of the turbine. Assemblies range in size from 36 to 42 inches in diameter.

Custom engineered assemblies include many features of Badger S-R Design

750°F steam is flashed through these turbine crossovers at speeds up to 150 ft/sec and pressures up to 150 psi.

How do you protect piping and turbine casings from the stresses of extreme internal pressure and the expansion such temperature is bound to produce?

Working together, Badger and engineers at General Electric's Large Steam Turbine-Generator Department solved the problem with a new type pressure balanced elbow expansion assembly. Using two separate joints mounted in a T-shape casing (see diagram) the assembly effectively absorbs and controls axial movement. Although the device was custom engineered to General Electric's requirements, the bellows elements are constructed to the Curvilinear Corrugation design recently announced by Badger and now used in all S-R Expansion Joints.

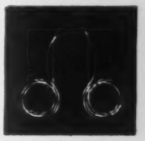
Whether you need standard S-R Expansion Joints or custom equipment, Badger can serve your needs. Get more information — write for illustrated brochure today.

New corrugation and ring designs produce better equalization, "all-curve" flexing

Curvilinear Corrugations used in S-R Expansion Joints were developed by the Badger Research Department. Under operating pressures (white line) the new design produces more uniform movement per corrugation and natural "all-curve" flexing. Stress is reduced . . . life increased.

Series 50 corrugation cross-section

S-R Joints for higher pressures have tubular Reinforcing Rings. These new rings make metal-to-metal contact only in the "valley" of each corrugation allowing natural "all-curve" flexing (white line). Tubular shape permits greater effective flexing height which contributes to longer life.



Series 150 corrugation and ring cross-section

BADGER

S-R

SERVICE RATED

EXPANSION JOINTS

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BADGER MANUFACTURING COMPANY

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...featuring flat
radial blade wheels

A packaged industrial fan is now offered to cope with virtually any industrial air or material handling problem. Weather cover is removable, and motors and drives may be installed, removed, serviced or adjusted on the job by one man. All units are rotatable and reversible in the field. Available in wheel sizes from 14 inch thru 36 inch. Send for Bulletins 585 and 586.

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For BIG
performance

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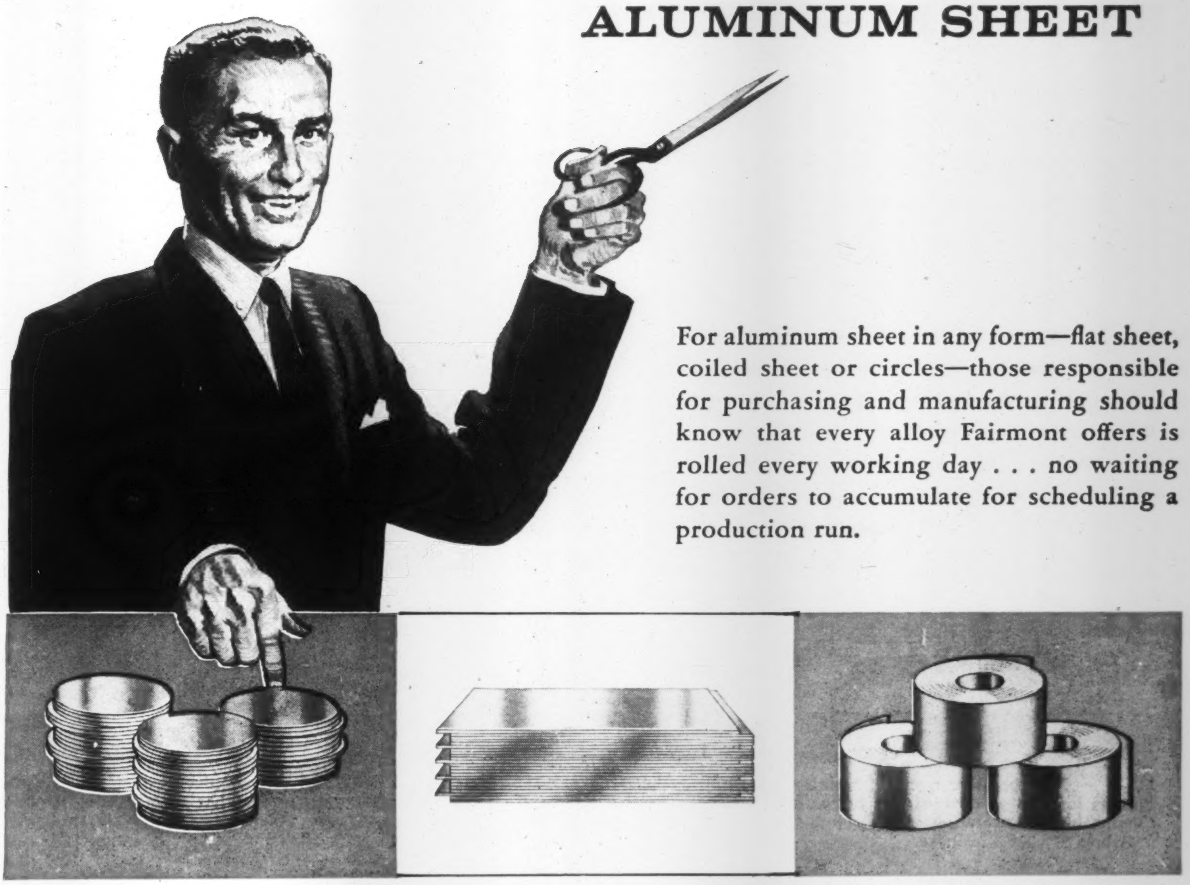

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- Manufacturing inventories are kept low, reducing investment in floor space and work in progress.
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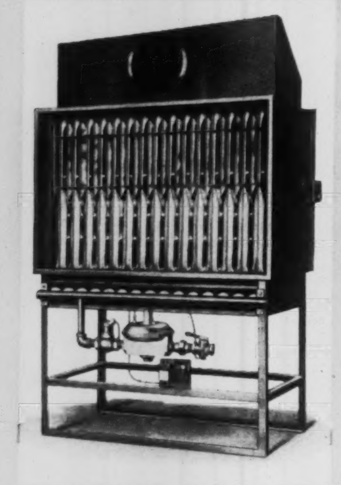
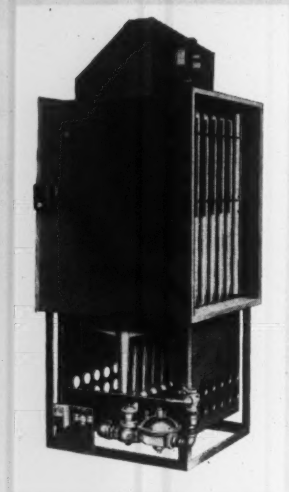
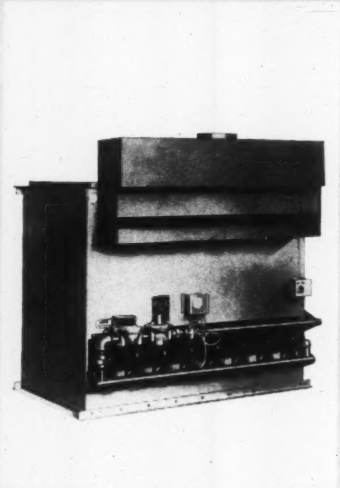


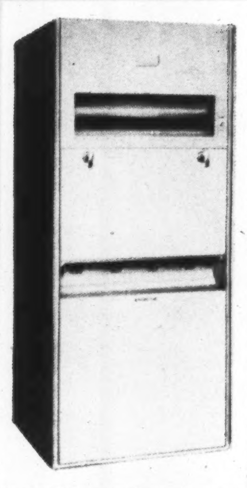
SED-E



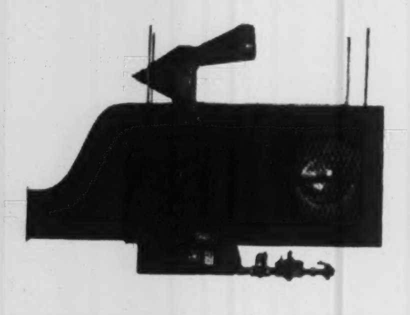
SED-S



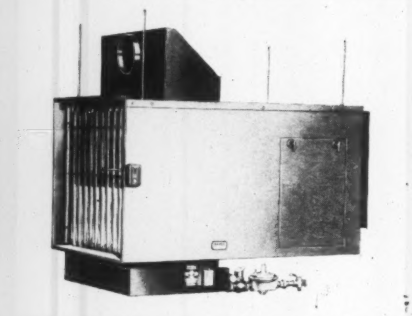
SED-VF



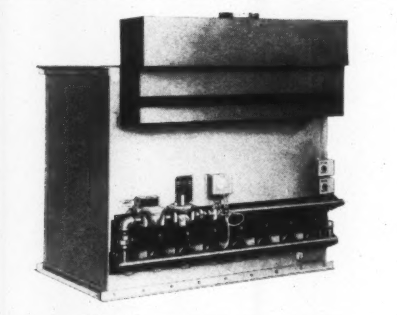
SEC



SEU



SES



SED-CF

SED-E — Non-corrosive type 321 stainless steel heat exchanger. Permits installation down-stream of cooling equipment, for continuous blower operation. Air through-put in either direction. 45,000 to 675,000 Btu input.

SED-S — Same as SED-E except controls are at the side. Either SED-E or SED-S is available in sizes from 45,000 to 675,000 Btu input in increments of 45,000 Btu.

SED-VF — Tested and approved as a duct furnace; type 321 stainless steel. Re-circulated or fresh air enters through bottom, sides, or back. Built-in air bypass, vent in front. 7 sizes from 70,000 to 280,000 Btu input.

SEC — Forced air furnace. Stainless steel heat exchanger sections seam and arc welded. One piece cast iron burners with drilled ports. Oversize double inlet blower. 7 sizes — 70,000 to 245,000 Btu input. For zero clearance.

SEU — Suspended unit heater. Recirculates room air. Diffuser outlet with adjustable vertical and horizontal vanes. Double inlet forward curve blower. Continuous duty, variable pitch drives, raised port burners. 80,000 to 480,000 Btu input.

SES — Forced air, suspended furnace for installation in suspended duct system. Designed for sheet metal duct connection. Double inlet forward curved blower. Continuous duty variable pitch drives, raised port burners.

SED-CF — Tested and approved as a duct furnace for counterflow. Recirculating fresh air thru the top. Has a built-in bypass. Sizes from 70,000 to 280,000 Btu input.

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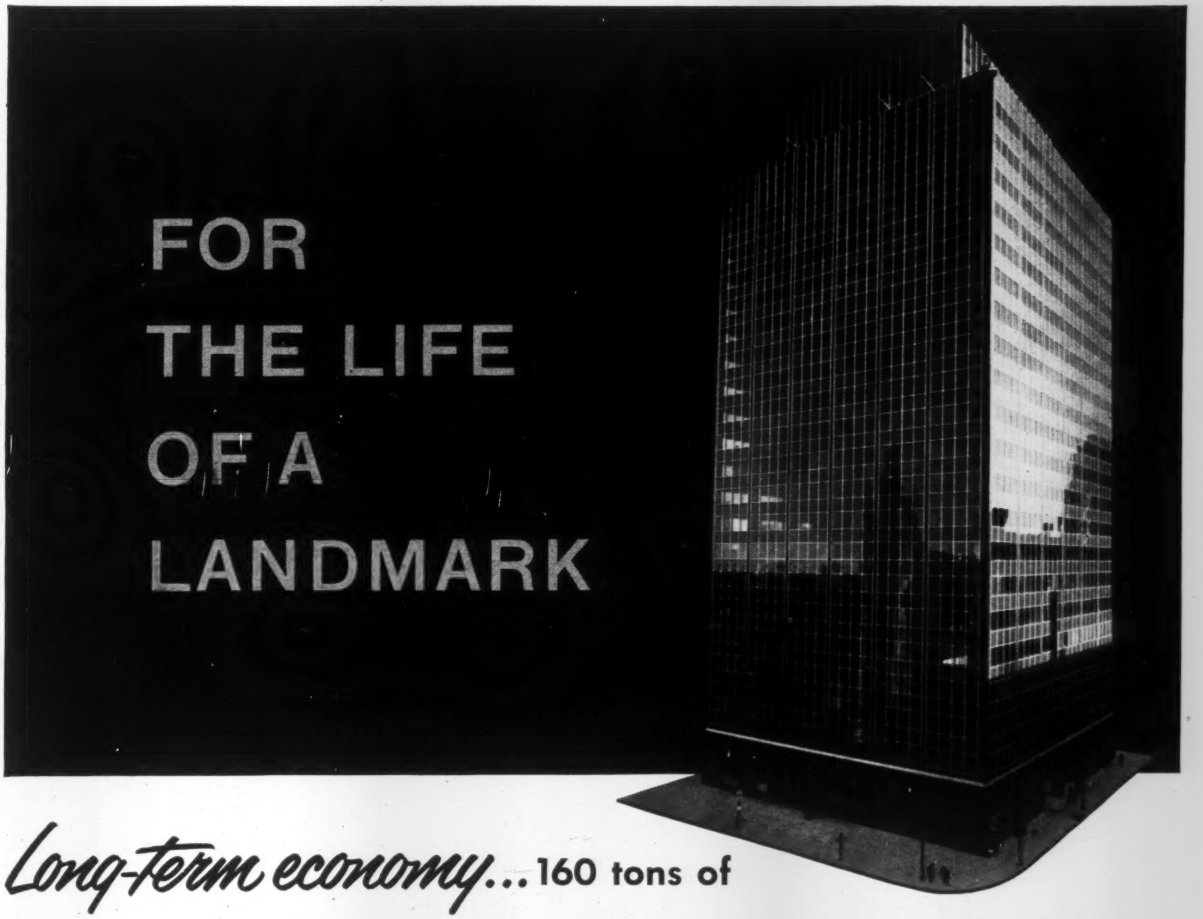

Long-Term economy... 160 tons of Republic Steel Pipe installed in Cleveland's new East Ohio Building

STEEL PIPE IS FIRST CHOICE

- Low cost with durability
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- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

INSIST ON PIPE MADE IN U.S.A.

The Gorman-Lavelle Plumbing and Heating Company installed Republic Steel Pipe in this new Cleveland landmark. *Steel pipe*—160 tons of it—because steel pipe is good for the life of a building, and costs considerably less initially. *Republic Steel Pipe*—because Gorman-Lavelle demands the highest possible degree of workability.

That workability is assured by Republic's constant quality control. You profit from easier bending, cutting, and threading. And, you can rely on the strength of steel for long, unsupported runs; on the availability of steel for minimum variation in price or delivery; on the tight galvanized coating of Republic Steel Pipe for stubborn resistance to corrosion and fabrication damage.

Learn more about the many outstanding economies that are yours with Republic Steel Pipe. Your local Republic distributor carries sizes and grades for every purpose. Contact him for complete information or write Republic Steel Corporation, Dept. HP-7521, 1441 Republic Building, Cleveland 1, Ohio.

CALL YOUR LOCAL REPUBLIC DISTRIBUTOR FOR QUICK DELIVERY OF STEEL PIPE

REPUBLIC *Steel Pipe*

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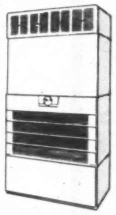
Look Inside YORK'S NEW STEP-BY-STEP AIR CONDITIONING PLAN...

See how York provides the perfect answer to budget-conscious prospects who want air conditioning—but imagine they can't afford it!

York's new zone cooling plan has wide appeal to prospects because of its flexibility and low cost. With it, they can air condition a room at a time, a floor at a time or an entire building, simply by installing York Packaged Units singly or in multiple. That means businesses with limited budgets can air condition the important zones first and add the remainder later. It means installation savings because York Packaged Units may be installed quickly and easily, without tearing down the walls or putting in special foundations. And, it means reduced operating costs because individual units may be turned off when not in use!

Complete Line of YORK Packaged Units Offer The Full Benefits of Air Conditioning!



York's Low Ambient Operation now makes it practical to remove stuffiness, excess heat and humidity in winter as well as summer! Other bonus features include exclusive Cooling Maze Coils that remove 30% more humidity, cool faster...heavy-duty filters that remove dust, dirt and air borne pollens...and gas-cooled, Sealed-in-Steel Compressors that provide longer peak performance!

York Packaged Air Conditioners available in single, double and triple compressor models, air or water-cooled, from 3 through 25 tons.

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SUSPENDED *GAS FIRED* FURNACES

priced to give you a competitive advantage in the commercial and industrial heating markets!

Another "*First*" for Shafconaire! A new line of suspended gas-fired furnaces designed *right* built *right* for commercial-industrial use—and *priced right*, too, to give you profitable, volume sales! For these new Shafconaires actually cost less than any other type of gas heating equipment of equal capacity on the market today. What's more, they're covered by all required approvals for immediate installation.

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- **Large Capacity**—designed to handle greater volume of warm air at higher velocity—can be easily connected to duct work to provide controlled distribution of heat.
- **Maximum Head Room**—approved for installation two inches from combustible materials, compactly designed to assure greater clearance.
- **Versatility**—quickly, easily adapted in the field for right hand or left hand installation.

AVAILABLE IN 6 BASIC MODELS TO GIVE YOU BROAD MARKET COVERAGE
85,000 — 97,000 — 112,000 — 142,000 — 182,000 — 252,000 BTU Output

In addition to these six basic models, Shafconaire Gas-Fired Furnaces can also be supplied for duct heater applications. All models are furnished complete with power burner, blower, controls and with or without filters as desired.

SHAFCONAIRE—*the Specified Line for '59!* More national chain organizations have specified Shafconaire this year than ever before. So get your share of this profitable "pre-sold" volume—send coupon today for specifications and prices on the entire line of Shafconaire Suspended Furnaces.

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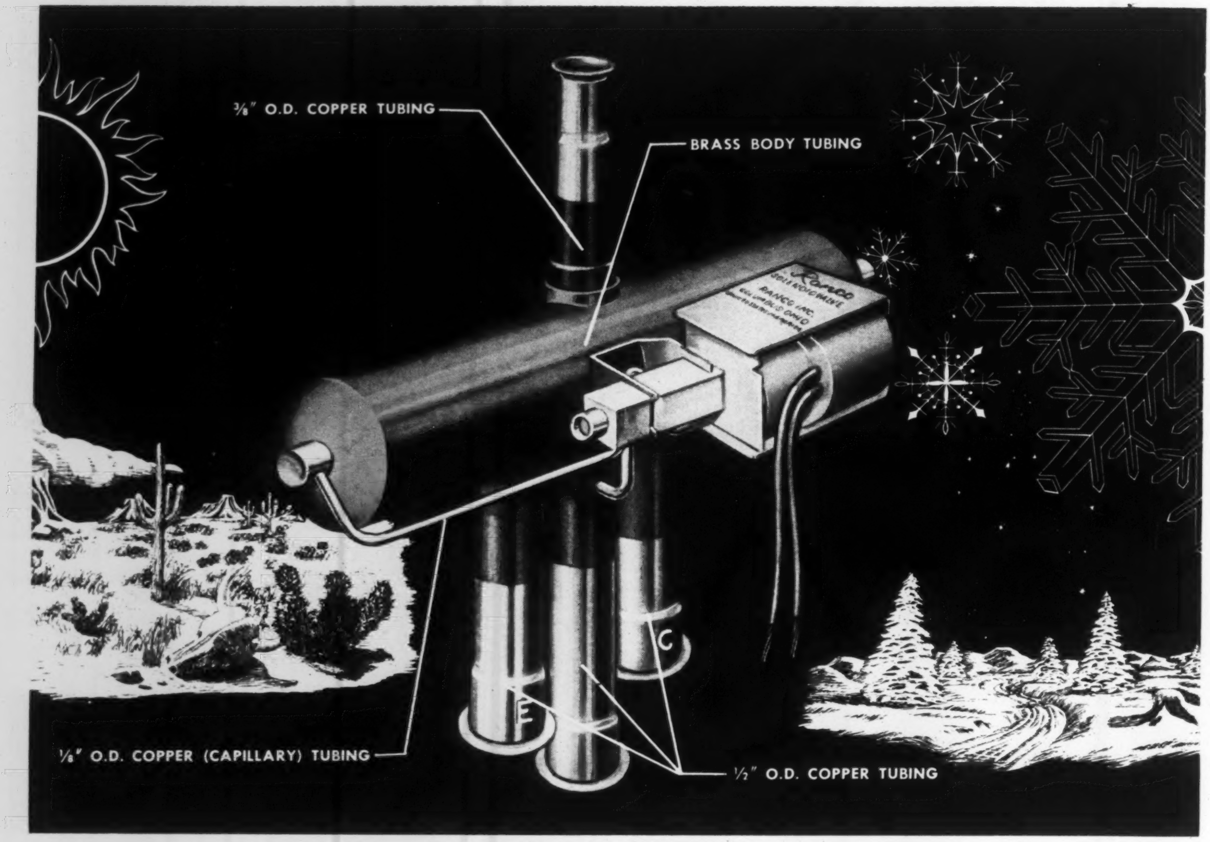

"Everybody talks about the weather..."

WOLVERINE TUBE HELPS RANCO ACHIEVE YEAR 'ROUND AIR CONDITIONING COMFORT!

Blow hot . . . blow cold . . . whatever the weather, the reversing valves manufactured by Ranco Incorporated, Columbus, Ohio, act as the nerve center for providing the right type of climate to meet either condition.

Ranco reversing valves control heat pump operation in air conditioning units—both window and central types. In cold weather, these units extract heat from outside air and circulate it indoors—in summer the cycle is reversed with heat gathered from indoors released outside.

Wolverine Tube manufactures much of the copper and brass tubing used by Ranco in manufacturing its reversing valves.

Among this tubing is Wolverine Capilator®—the tiny capillary tubing for precision metering of liquids and gases. The valve body proper is formed from Wolverine brass tubing and the ports leading to the compressor and inside and outside exchangers are manufactured from Wolverine copper tube.

Wolverine Tube is proud that its tubular products are so widely used by Ranco and other leading manufacturers throughout American industry . . . believes that this is the result of its Tubemanship program from which comes tubing conceived in research and sound engineering and backed by years of experience.

If your company uses copper, copper alloy or aluminum tubing get the Wolverine story before you order again. Just write for your free copy of the "Measure of Tubemanship." Do it today.

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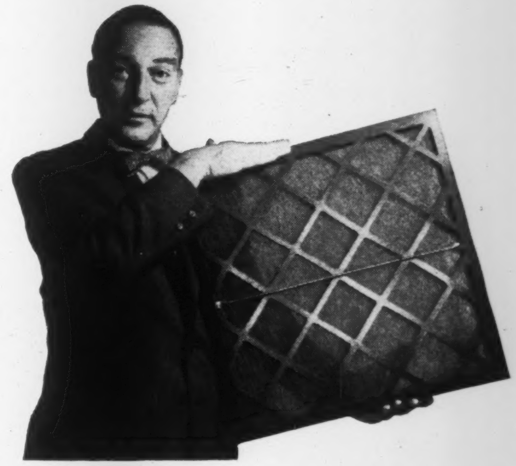
"This should happen to a filter? Just in case you ever bent a Glasfloss Filter like this, you'd find it would snap back in shape. That's because of its one-piece chipboard construction. No metal grille to get bent out of shape. There's less chance of filter damage in transit, storage and handling."



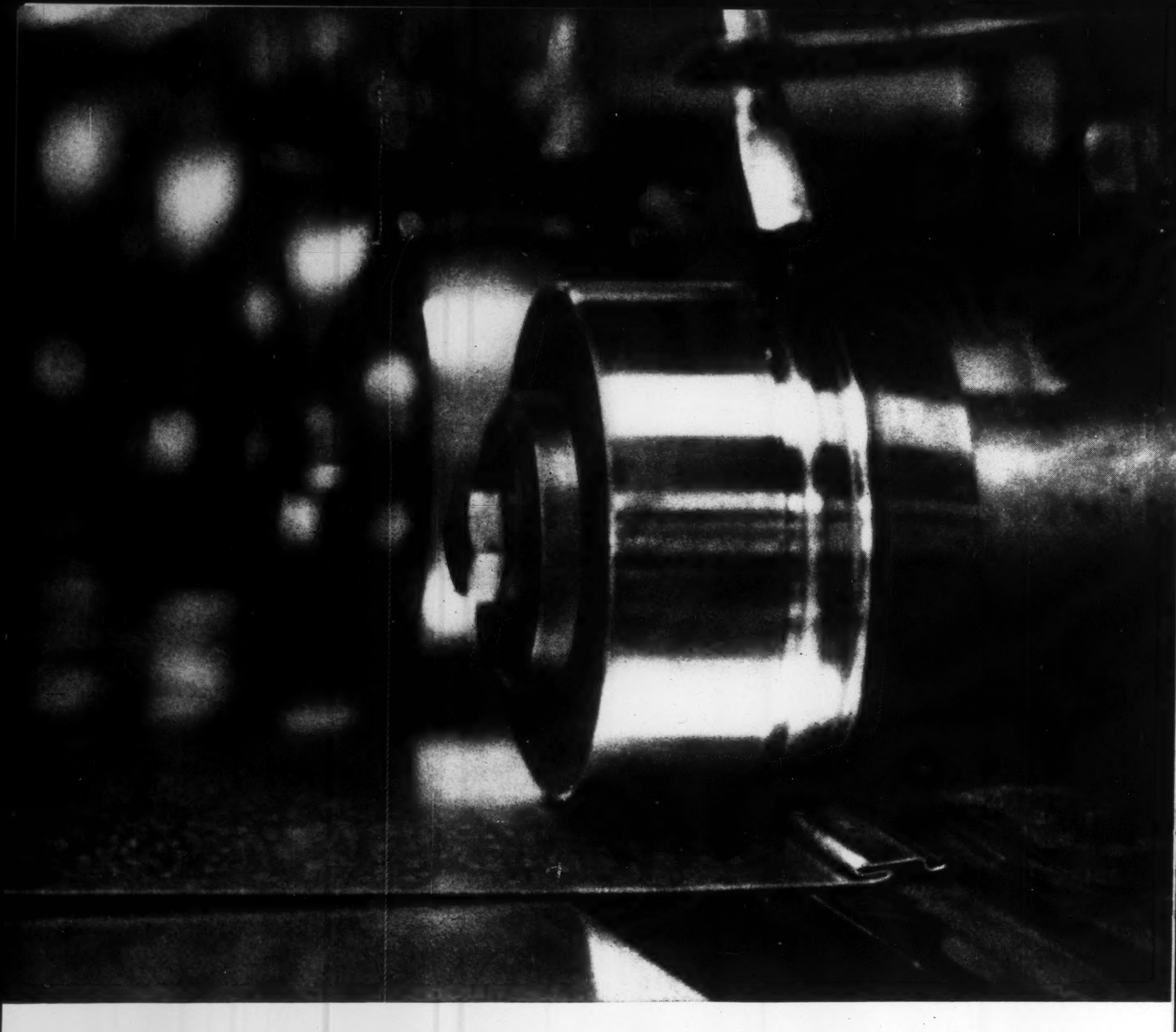
"Efficient? You bet! But don't take my word for it. Try Glasfloss Fiber Glass Safety-Grille Filters yourself and see how well they perform in actual service. Your local Glasfloss Distributor or PPG Warehouse carry the complete range of sizes. Call them for service, and tell them Garry sent you."

Glasfloss® Safety-Grille* Filters are a product of the Fiber Glass Division of Pittsburgh Plate Glass Company

Sales Offices are located in the following cities: Charlotte, Chicago, Cincinnati, Cleveland, Detroit, Houston, Los Angeles, Minneapolis, New York, Philadelphia, Pittsburgh and St. Louis

*Trademark

FIBER PG GLASS PITTSBURGH PLATE GLASS COMPANY



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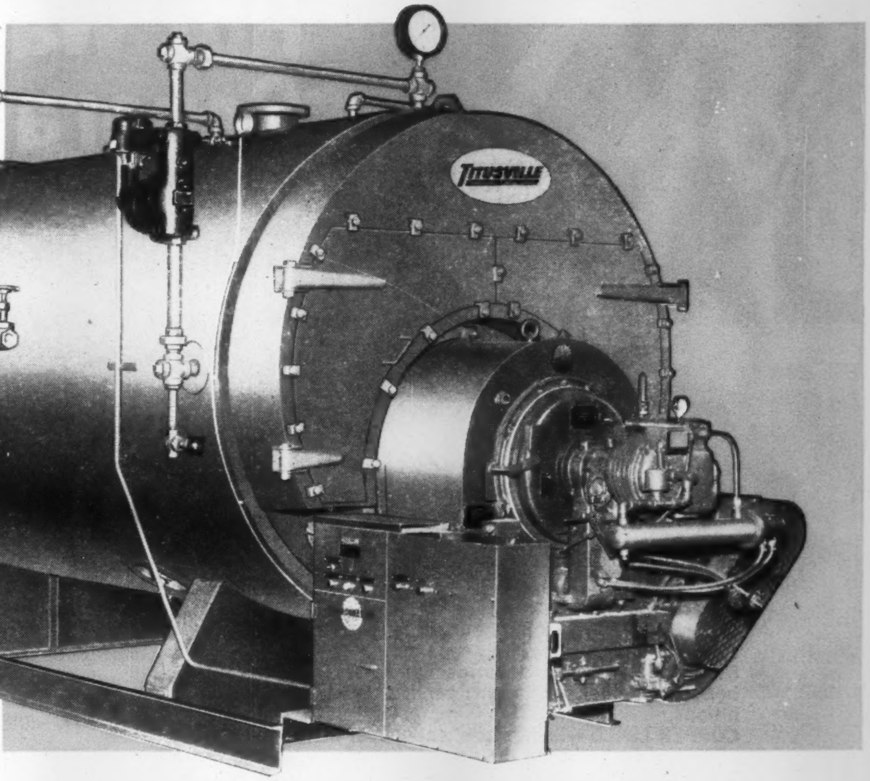

THE TITUSVILLE TITAN
3-PASS UNIT
FOR POWER AND HEAT

3-PASS UNIT

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The TITAN 3-Pass Unit brings you today's highest development in mechanical and thermal efficiency for exacting power and heating applications. Compact design in every size joins with TITAN's all-wet-back construction, water-cooled rear combustion chamber and modern 3-pass heat transfer to make this unit *your first consideration* when boilers are up for discussion. Let us consult with you, now!

Send today for your free copy of the new TITAN Bulletin B-3240 . . . contains full data on the TITAN Unit line.

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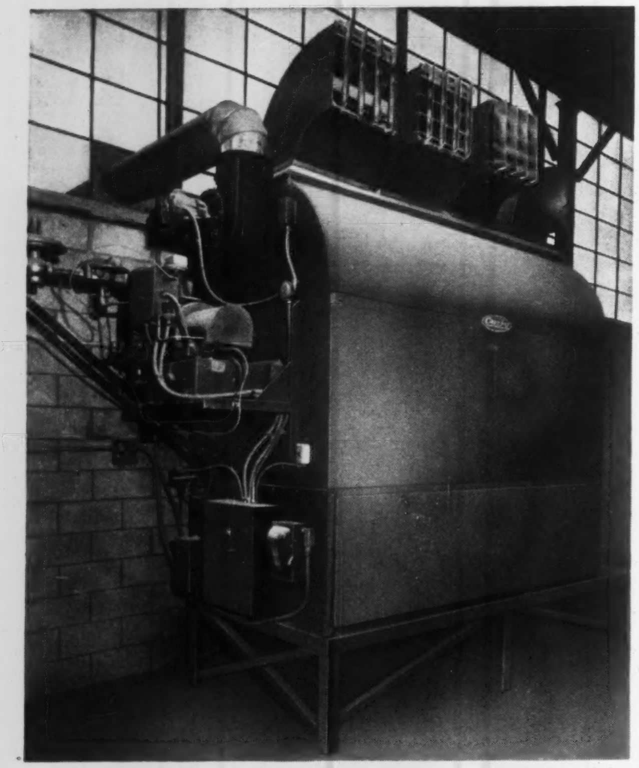
Boat builder gets low-cost comfort with Carrier Heat Diffuser—Direct-Fired



If your problem is finding the best way to heat a large area at low cost, here's what Owens Yacht Corporation's Cutter Boat Co. subsidiary did.

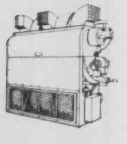
To heat 70,000 square feet of new plant space, Cutter Boat installed two Carrier Heat Diffusers—Direct-Fired to provide 3,000,000 Btus. Both are fired by natural gas. One is used for heating only, the other for heating and ventilating.

Completely self-contained Carrier Heat Diffusers—Direct-Fired, heat or heat and ventilate factories, warehouses and other large buildings at minimum cost. They can be floor-mounted or suspended from wall or ceiling—wherever there's space. No need to worry about special foundations or extra rooms. They heat immediate areas or they can be fitted with ducts to heat other sections.

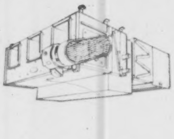
Customers will be sure of top fuel economy with any gas or light or heavy oil. Carrier's "Big Circle" heavy-gauge stainless steel combustion chamber and modern design assure utmost combustion efficiency. Unit sizes range from 300,000 to 2,000,000 Btu hr.

For facts on low-cost heating of large areas with Carrier Heat Diffusers—Direct-Fired, call your Carrier Wholesaler. He's listed in the Yellow Pages under "Heaters—Unit," or write Carrier Corporation, Syracuse, New York.

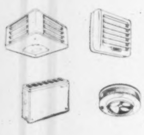
Carrier offers every type of equipment for any commercial or industrial job



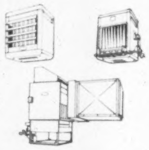
Heat Diffusers — Direct-Fired for all types of fuel



Heat Diffusers for steam and hot water



Unit Heaters for steam and hot water



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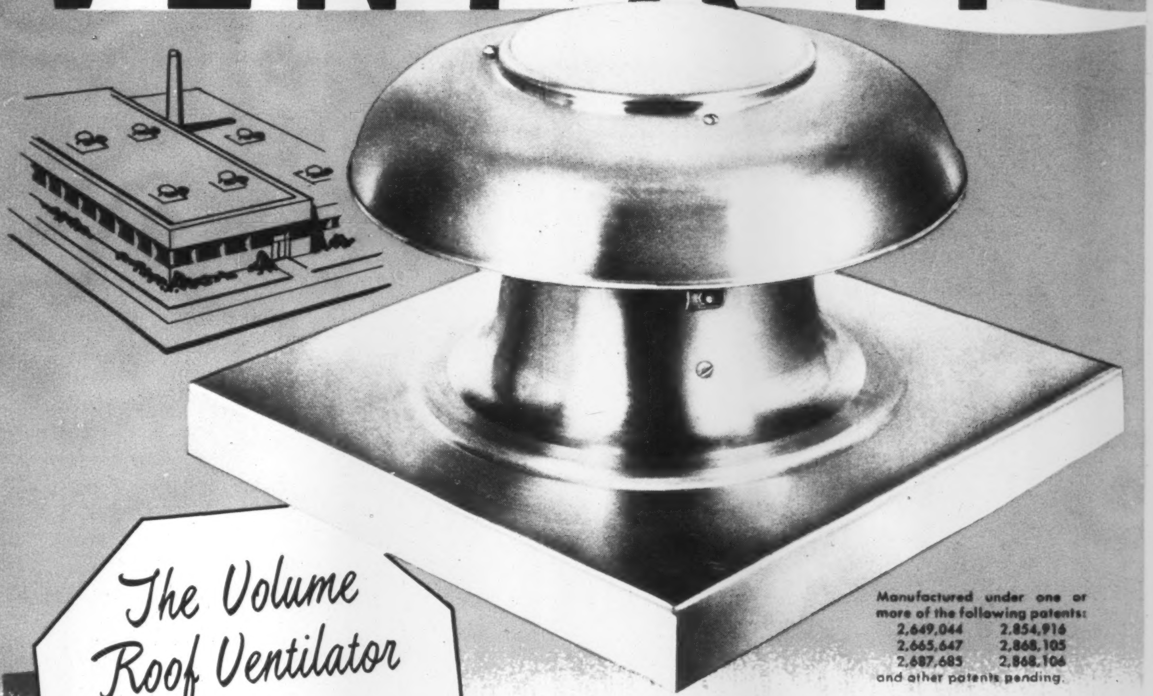

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2,665,647 2,868,105
2,687,685 2,868,106
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The Volume Roof Ventilator Of Handsome Craftsmanship

● Looks good—acts good—is good at exhausting masses of obnoxious air Designed for low silhouette buildings that require more dependable ventilation, VENT-X-IT is manufactured in a variety of sizes and capacities with either direct or belt driven axial or centrifugal backward curved non-overloading fans. Heavy gauge spun aluminum housing throughout will last the life of the building, maintenance is practically nil, and installation as simple as putting on your hat. Can be supplied without fans and motors for air intake or as relief ventilators.

The VENT-X-IT is an important member of the complete line of Octagon roof ventilators. From the smallest shop to the largest industrial plant there is a powered or gravity Octagon for all conditions and volume of air.

Capacities rated in accordance with standard test codes by the Texas Engineering Experiment Station.

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That's what one of our new customers volunteered about Bethcon a few weeks ago. He's no metallurgist, so he couldn't elaborate very much on his statement. But here is the probable reason for his enthusiasm:

Bethcon is galvanized in Bethlehem's up-to-the-minute continuous lines at Sparrows Point, Maryland, which include a continuous annealing process. This treatment gives the steel a very desirable combination of ductility and stiffness, which makes for easy workability and a strong, rigid sheet-metal product.

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Bethcon is available in gages 13 and up, in either plain open hearth or copper-bearing steel. A Bethlehem representative will be glad to discuss your sheet metal problems with you. Just call or write to the Bethlehem district office nearest you.

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BETHLEHEM STEEL

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FOR RADIATION AND WATER HEATING

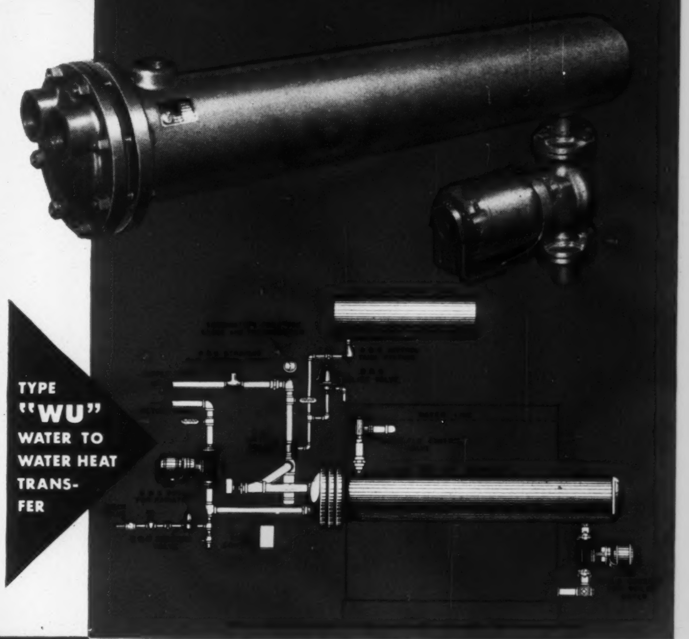
When you install a B&G Heat Exchanger, you have assured yourself of not only high efficiency, but highest quality construction.

With each B&G Exchanger, a Manufacturer's Data Report for Unfired Pressure Vessels, Form No. U-1, as required by the provision of the A.S.M.E. Code rules, is furnished. This form is signed by a qualified inspector, holding a National Board Commission, certifying that construction conforms to the latest A.S.M.E. Code for unfired pressure vessels. The A.S.M.E. "U" symbol is stamped on each exchanger.

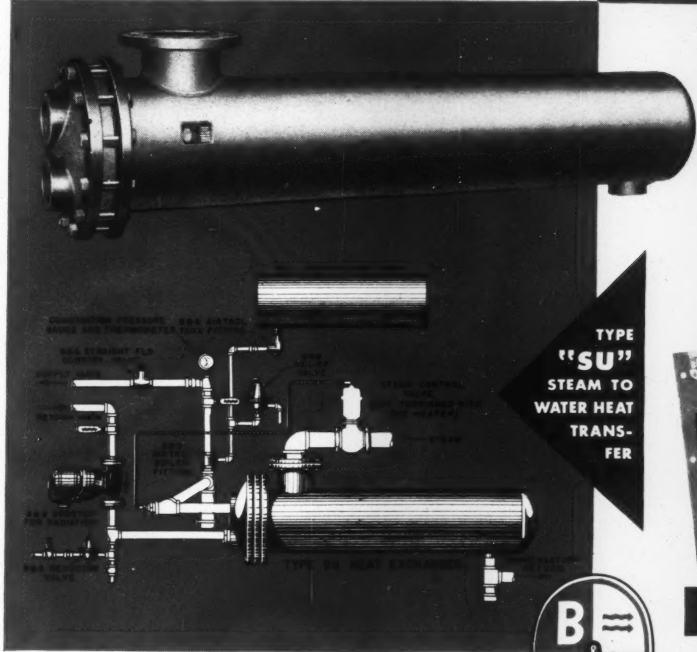
TYPE "WU"

The "WU" Exchanger is equipped with a B&G Booster which pumps boiler water through the shell, greatly increasing the capacity of the unit. An unbelievably small "WU" produces large volumes of hot water. Water temperature is closely controlled . . . the Booster starts whenever the water goes below the desired degree and continues to run until the water is again at the proper temperature.

When used as a service water heater, a storage tank can be eliminated, because the "WU" heats water as rapidly as it is used.



TYPE "WU" WATER TO WATER HEAT TRANSFER



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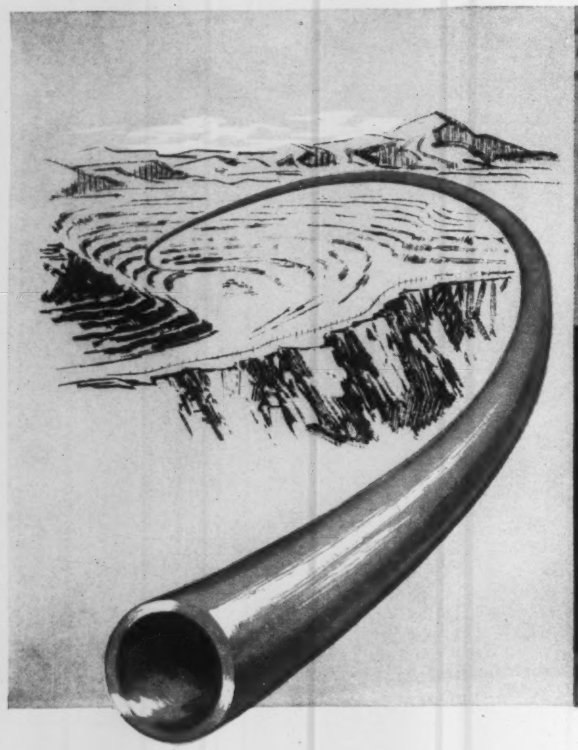
Phelps Dodge Copper Water Tube



ON, INC. PLUMBIN
PHELPS DODGE
COPPER WATER TUBE
PHELPS DODGE COPPER PRODUCTS CORPORATION
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TYPE L

Famous Mine-to-Market Quality that means Dependability

Phelps Dodge copper water tube's outstanding reputation for superior quality is the result of complete Phelps Dodge control of materials and manufacturing methods, from the mining operation to the finished product. Phelps Dodge water tube is made of the highest grade copper from Phelps Dodge's own mines . . . is carefully controlled for quality throughout fabrication . . . and has unsurpassed tube properties, including precise uniformity of wall thickness, due to Phelps Dodge's unique Hot Forged-Extrusion Process.

Dependable Distributors with Complete Service Facilities

Phelps Dodge distributors can supply plumbing and heating contractors from complete stocks of pipe, copper water tube, copper drainage tube, copper refrigeration tube and other essential plumbing equipment of all kinds . . . everything needed for home building, industrial expansion, heating and air conditioning and factory maintenance. Phelps Dodge distributors also offer expert advice and valuable job tips, plus practical knowledge from Phelps Dodge representatives that help to solve on-the-job problems.

Your Phelps Dodge distributor has the best of everything: top-quality products and friendly service!

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MADE IN U.S.A.
TO THE STANDARDS
OF AMERICAN INDUSTRY

A new development by Iron Fireman

WhirlBlast
TRADE MARK
DUAL-FUEL BURNER

FORCED DRAFT... no stack draft required
DUAL FUEL... gas or oil — instant changeover
CLEAN... no air pollution
PACKAGED... everything built-in, ready to go

New high in combustion efficiency and fuel economy

with this revolutionary burner for medium size boilers

This compact Iron Fireman WhirlBlast unit combines many of the advantages of big burners, yet it requires little more supervision than the oil or gas burner in your home.

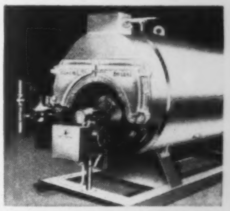
No stack — no draft problems. Air supply is precisely controlled under all conditions. The WhirlBlast burner eliminates the need for a costly and unsightly smokestack, and also eliminates the noise, bulk and high power requirements of induced draft firing. This burner starts clean and burns clean, with no soot or smoke problems.

Steadiest flame ever developed. In the new WhirlBlast firing head Iron Fireman engineers have solved the persistent problem of flame pulsation. A clean, steady, efficient flame is achieved without firebox vents or any other makeshift device.

Fires gas or light oil; changes fuels instantly. Quick fuel changeover can be accomplished with the flick of a switch, or automatically with special controls. Models available for firing either gas or oil exclusively.

A true "package". When you bolt the WhirlBlast unit to the boiler front you install a complete forced draft firing system, combining air and fuel systems and integral electronic combustion controls. It leaves the factory as an operating unit, factory wired and tested. Does not require refractory combustion chamber, nor any provision for secondary air supply.

For all types of boilers. The WhirlBlast burner can be purchased in two ways: as a boiler-burner unit (shown at right), or as a burner alone for use in your present boiler.



Complete boiler-burner unit, ready to operate. Boiler and burner compose a single unit, engineered, assembled, wired and tested at the factory, carrying factory responsibility. Requires little more than service connections when delivered to the job. Sizes from 15 to 100 boiler horsepower.

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AUTOMATIC FIRING EQUIPMENT
FOR HEATING, POWER, PROCESSING

IRON FIREMAN MANUFACTURING CO.
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Please send me more information and specifications on the Iron Fireman WhirlBlast burner.

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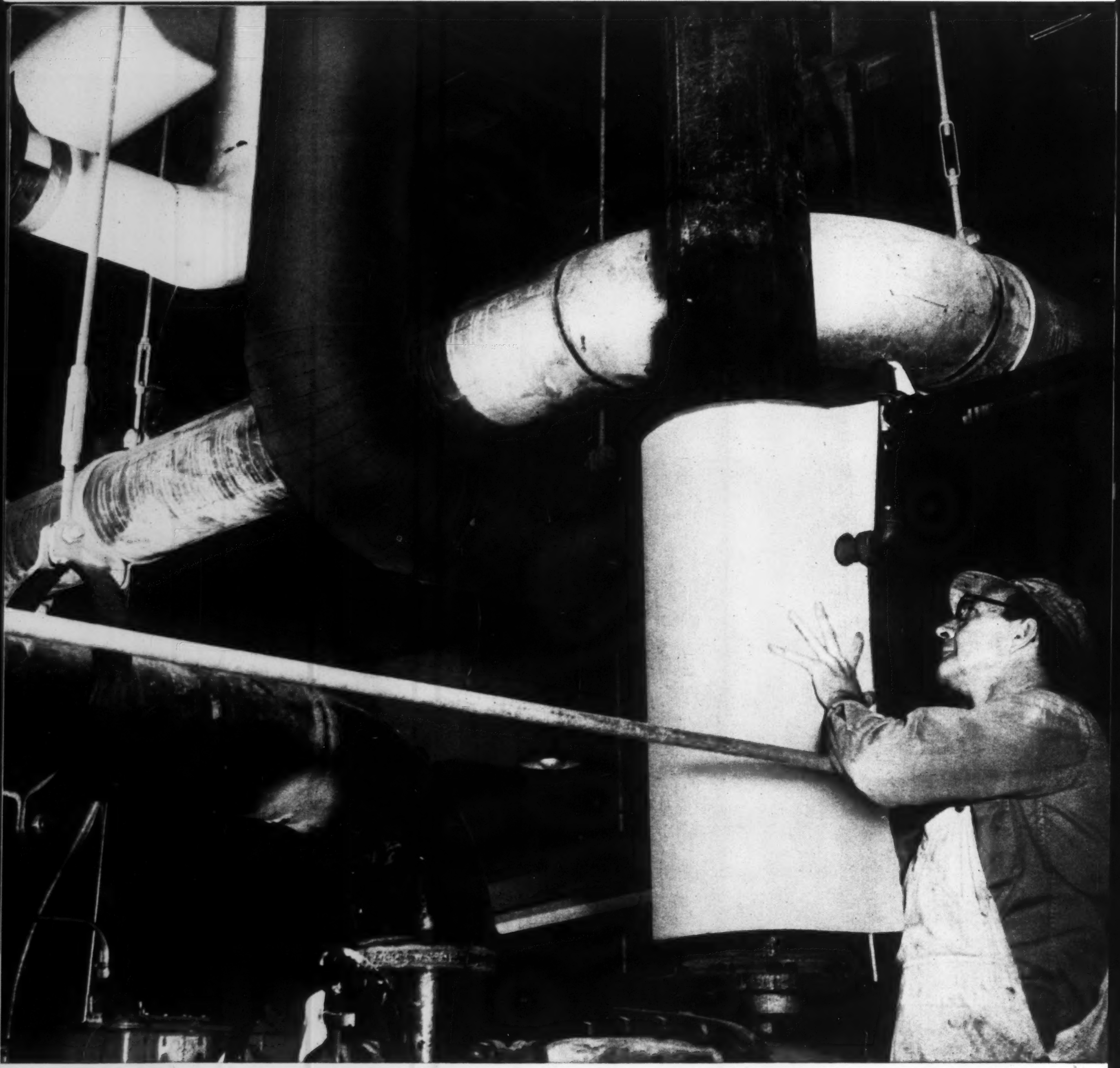
City........................ Zone...... State..........



They compared "K" factors and cost factors . . . and bought SNAP*ON®

Compare insulations for plant piping jobs, for example — and you will agree that for economy, performance, and thermal efficiency, there is *nothing* like Snap*On, the original one-piece pipe insulation molded of fine glass fibers. It's far cheaper to apply under all plant conditions — crowded quarters . . . long straight lines . . . hot or cold piping that involves numerous bends, valves, and obstructions. And Snap*On is the only one-piece insulation available in a complete range of sizes from copper tubing to 36″, plain or with jackets. But see for yourself — ask your local G-B distributor to make a TEVA (Thermo-Economic Value Analysis) survey so you can compare "K" factors and cost factors as they apply to your own insulating jobs.

FOR FREE TEVA SURVEY CALL YOUR LOCAL
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LISTED IN YELLOW PAGES

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Thermal and acoustical glass fiber insulations . . . molded glass fiber pipe insulation
Couplings and fittings for plain and grooved end pipe

Men who know pipe point to
WHEATLAND

for EASY THREADING

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INSIST ON PIPE MADE IN U. S. A.

Steel pipe that cuts and threads easily and evenly—Wheatland Steel Pipe—is singled out by more *knowing* men every day. They know that Wheatland Pipe saves them time, minimizes wear on tools and reduces labor fatigue. Every length is backed by Wheatland's sincere desire for complete customer satisfaction. Next time, point to Wheatland!

...pipe with the yearmark!

For Black or Galvanized Pipe, contact your distributor or

WHEATLAND TUBE CO.

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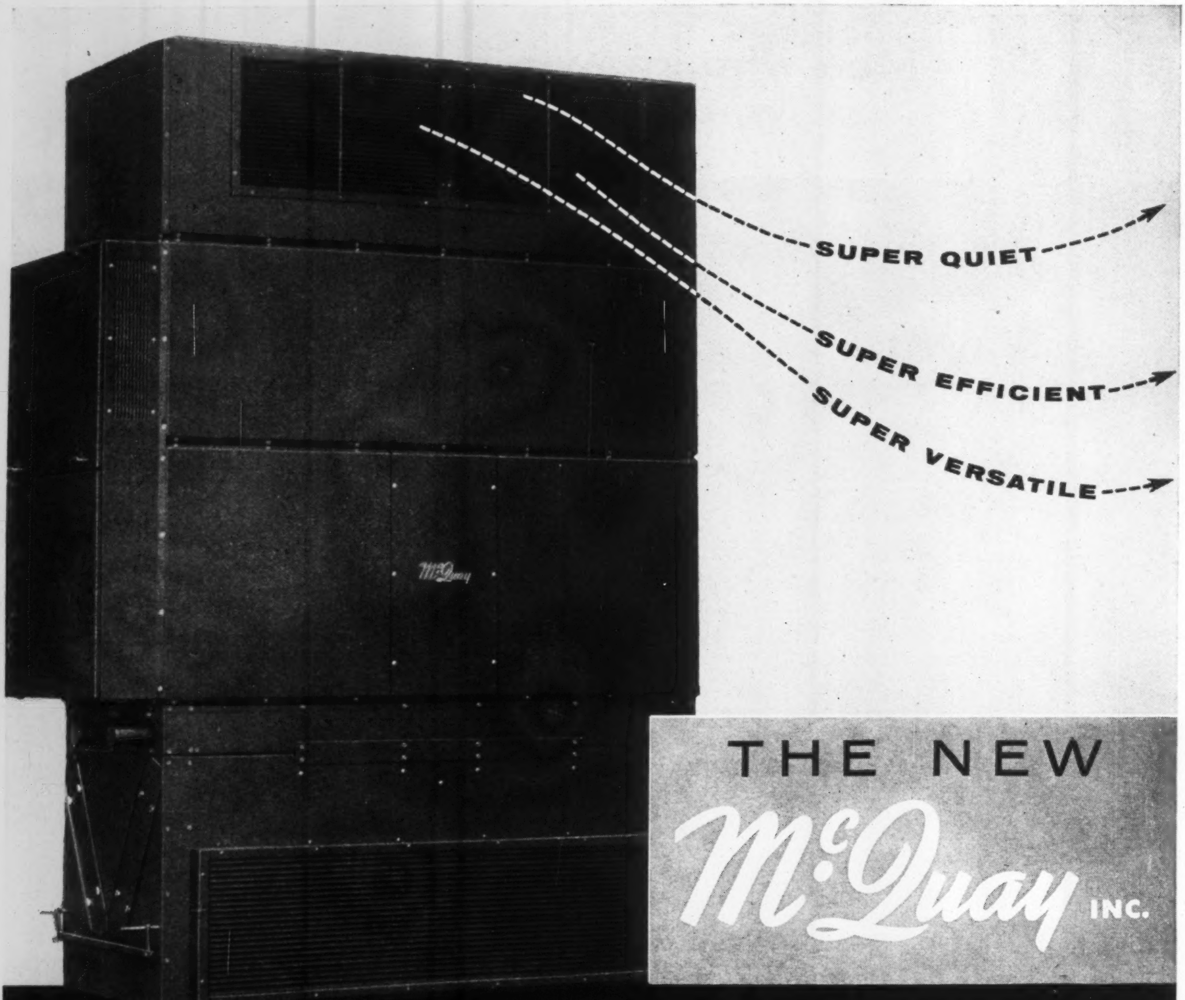


THE NEW

McQuay INC.

SEASONVENT

Here is a super quiet, super efficient, and super versatile heating and ventilating unit. This new McQuay Seasonvent large capacity unit is engineered specifically for applications such as school auditoriums, theatres and similar installations where smooth and quiet operation is a necessity.

This Seasonvent is available in nine sizes for low static applications (0″ to ⅝″) and seven sizes for high static applications (¾″ to 1¼″), with capacities ranging from 1250 to 15,000 cfm.

All McQuay Seasonvent models are equipped with highly efficient sound absorbing plenum sections with the fan motors internally mounted. They are available in horizontal, vertical or wall mounted arrangements.

For complete information on this new unit, contact the McQuay representative in or near your city, or write McQuay, Inc., 1601 Broadway Street N. E., Minneapolis 13, Minnesota.

McQuay
Means Quality

MAKE THE SEASONS COME TO YOU

McQuay INC.

AIR CONDITIONING • HEATING • REFRIGERATION

For *extra quiet* operation...

WAGNER 10 HP RESILIENT MOUNTED MOTORS

are vibration free··sleeve or ball bearing

Today, many motors are installed in areas where noise must be held to a minimum — in hospitals, churches, schools, office buildings, restaurants and similar locations where quiet is essential or desirable.

Such installations have created a need for larger polyphase motors that are exceptionally quiet and vibration-free. Wagner has filled this need by expanding its line of polyphase resilient mounted motors to include standard ratings through 10 hp.

If you have an application that calls for a smooth running motor, cushioned by resilient mountings, it will pay you to specify these Wagner Motors—a complete range of ratings from 1 through 10 hp.

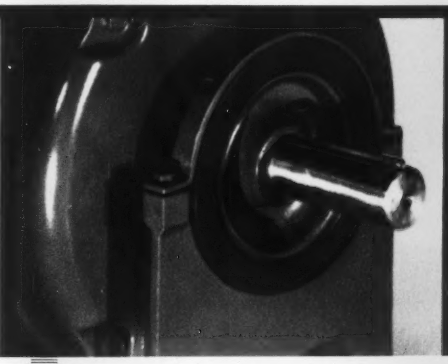
Constant research and development have kept Wagner up front in electric motor design for more than 65 years—made the name Wagner one you can trust in choosing electric motor drives.

Your nearby Wagner Sales Engineer can help you select the *right* motor to meet your requirements. There are Wagner branch offices in 32 principal cities.

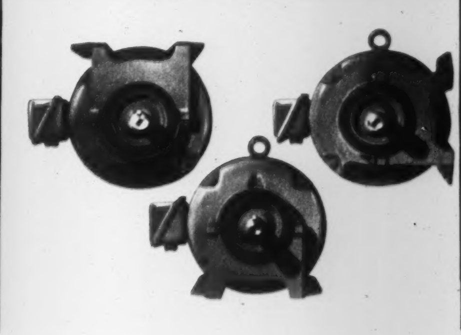
Wagner Electric Corporation
6400 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

SLEEVE OR BALL BEARING. These motors are furnished with quiet running steel-backed babbitt lined sleeve bearings that have high load carrying capacity. Ball bearings can be supplied when desired.

NEOPRENE CUSHIONING RING. Annular mountings, of neoprene bonded to steel rings, cushion the motor in its cradle base to absorb the small amount of vibration that remains in the most carefully balanced motor.

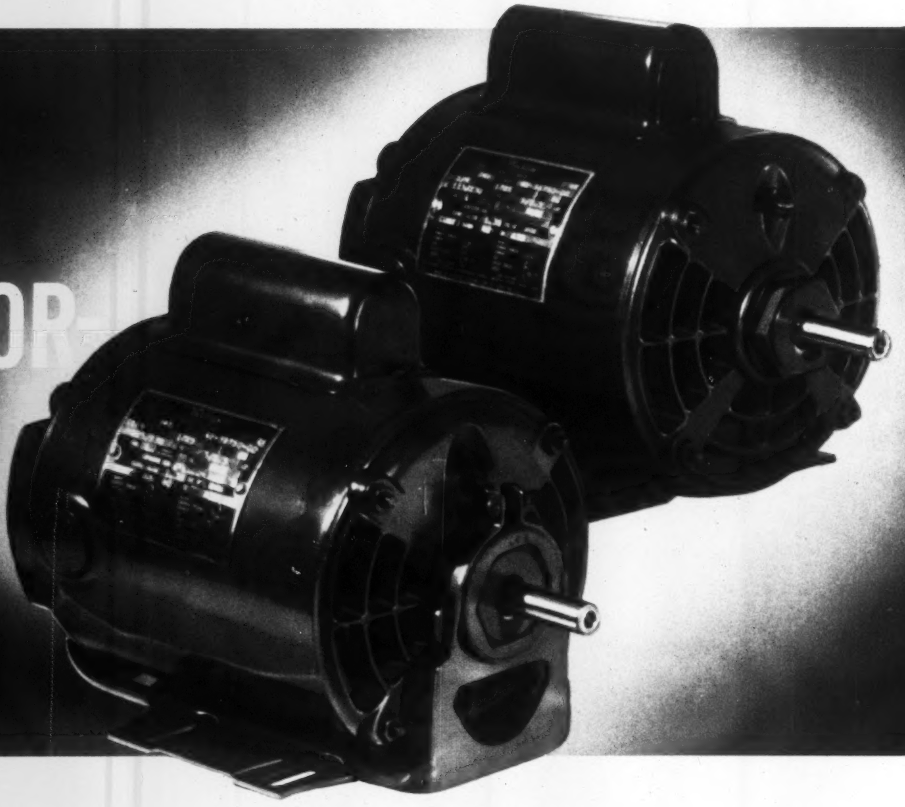


CEILING, SIDEWALL OR HORIZONTAL MOUNTING. You can mount these motors on walls or ceilings by rotating the cradle base 90° or 180°. The motor is designed to remain completely drip-proof in any horizontal position.



Pack MORE POWER Into LESS SPACE

WAGNER CAPACITOR-START MOTORS



PROVIDE DEPENDABLE STARTING...GIVE LONG TROUBLEFREE SERVICE... OPERATE IN ANY POSITION

Here's the single phase general purpose motor that gives quick troublefree starts every time—thanks to a Wagner-designed quick break switch . . . that has earned the Wagner motor reputation for giving long troublefree service . . . that permits all angle operation in sleeve bearing fhp models.

Wagner Type RK Motors give more horsepower with less bulk—are ruggedly built to permit direct mounting—are small enough to fit in tight spots. Available in a range from ⅙ through 5 horsepower, with either sleeve or ball bearings, with rigid bases or with resilient mountings for exceptionally quiet operation.

You can get these motors from leading motor distributors in your community or through Wagner Sales Offices in 32 principal cities. Your Wagner Sales Engineer will be glad to help you select the right motor for your application. Wagner Bulletin MU-217 gives full details on Capacitor-start Motors.

Wagner Electric Corporation
6400 PLYMOUTH AVENUE, ST. LOUIS 14, MISSOURI

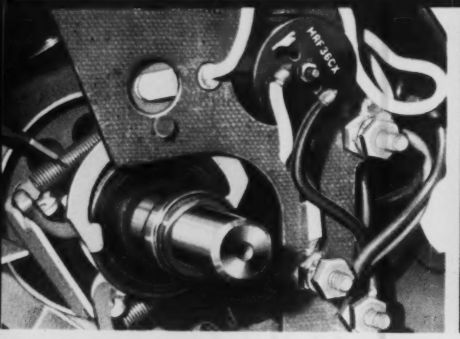
WM59-11

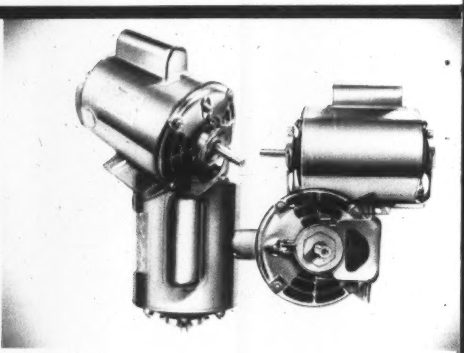
QUICK BREAK SWITCH. The starter is disconnected from the line by this Wagner-designed switch—test proved to make more than a million breaks. (That adds up to two starts per hour for 50 years!)

MYLAR* INSULATION. Mylar-paper insulated slot insulation gives excellent protection against moisture, adds thermal stability that gives these motors longer life when unexpected overloads occur.

*DuPont Trademark

ALL-ANGLE OPERATION. The sleeve bearing design, in fractional hp ratings, has a positive lubrication system that permits operation in any position . . . can mean important savings in motor costs to manufacturers.





"open for discussion"

• WE FOLLOW HERE each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

Laud Originality of HTHW Heating System, But Question Its Value

THE IDEA of radiant heating with central air supply, described in the article *High Temperature Water Heats New School*, by J. S. Blossom (March), is not new, but the author has introduced a novel idea in using high temperature hot water for the heating medium. It is gratifying to read such a detailed analysis of a system which has been widely accepted in this area as a logical, flexible, and satisfactory solution to the school heating and ventilating problem.

We have found that in a classroom with ceiling heights of 9 ft to 9 ft 6 in., radiant ceiling temperatures in excess of 110 to 120 F cause discomfort from localized heating. It would seem that the use of 340 to 400 F radiant elements would be more unsatisfactory, being even hotter than the ceiling-hung cast iron radiation of years ago.

The use of the two-fan system for the central unit is a good feature and works effectively when properly controlled. Unusual conditions, which frequently occur due to continuous opening of outside doors for admitting children at the beginning, noon hour, or end of school sessions, may result in reduced pressure within the building, with an inrush of uncontrolled outside air causing cold corridors. By using only one supply fan of ample capacity, it has been proven beneficial to use gravity exhausts from corridors and maintain sufficient building pressure to reduce uncontrolled infiltration during classroom hours and to minimize cold corridors at these certain times.

The author has not defined the control system in detail, but it is inferred that the radiant coil water temperature varies inversely with the outside air temperature and that cooling, if required, is obtained by varying the amount of air admitted to each room from the central system. The air temperature carried in the central system may be from 50 to 55 F.

No mention is made of economy afforded by night setback, which can appreciably reduce the fuel bill when used nights, weekends, and vacations. By controlling the central system by proportioning outdoor air and makeup air, the use of reheat and preheat coils in the central unit is eliminated.

When the reheat coils are installed in each classroom supply duct, the air quantify can remain constant, affording good circulation within the room at all times, and cooling or heating is available as needed. The radiant surface can then be designed to compensate for building losses to, say, 60 F, and the balance of the heat required for occupancy can be supplied by the air circulation. Night setback is obtained by merely shutting down the central air system. For nighttime use, the gymnasium, auditorium, kitchen, and cafeteria should each have its own supply system, together with gravity, power or combined exhaust system, whichever best suits the use of the rooms.

The use of electrostatic filters is an excellent idea if it can be afforded. The pollen control of such an installation, particularly for schools in the country, should be well worth considering. An activated carbon filter should also be considered for preventing the spread of odors from the gymnasium and kitchen throughout the building.

Referring to safety, we note that Mr. Blossom has considered the full break of a pipe which he has analyzed fully and completely. The danger which we would expect from such a system would lie in a pin-hole leak shooting a high pressure stream of vapor and water, practically invisible, but able to cut like a knife. Insulation of exposed lines might reduce the hazard in a degree, but such a leak would soon pierce the normal insulation materials and become dangerous.

Type and thickness of insulation would be an interesting item for Mr. Blossom to discuss, outlining some of the "or equal" phases of materials chosen.

The article is very interesting and provides food for thought, but has not done much to answer objections raised to the use of HTHW for heating over the past 25 or 30 years. We heard of this first in 1939 when a firm tried to introduce it in this country, claiming it was so successful in Europe. Frankly, I cannot see that the economic gain, afforded by use of smaller lines, compensates for the higher cost of high pressure equipment and higher radiation losses at elevated temperatures.

E. Jackson Whitman
Robson & Woese, Inc.
Consulting Engineers
Rochester, N. Y.

The author's reply — Complaints have not been experienced from localized heating in temperature ranges from 200 to 400 F with flat surface panels and tubular elements. The relatively small area of the tubular elements in comparison with the total ceiling area is a large factor in eliminating the discomfort described. We sorely feel the need of more specific information that could be applied to the design of radiant heating systems as to the effect of variously shaped and located surfaces at different temperatures upon the physiological response of individuals. Our field reports for systems in operation have consistently indicated a greater degree of environmental comfort with combinations of radiant heat plus ventilation than with some other types of heating and ventilating systems.

The two-fan central ventilating system is provided with return air, outdoor air, and exhaust air dampers. These are controlled from minimum settings by mixed air and room air temperatures to give constant exfiltration. The main lobby has a radiant heated ceiling panel which we believe will do more to minimize the cold corridor situation than could be accomplished by the ventilating system.

The temperature of the water supplied to the radiant heating panels does vary inversely with the outside air temperature. The temperature of the air carried in the central system will provide cooling of the room at all times so that the interior section of each room may be cooled while the radiant elements are heating the exterior section of the classroom.

The danger from pin hole leaks shooting a high pressure stream of vapor and water has never been observed by us in systems of this type in spite of a large number of observations of leaks of all sizes. Pin hole leaks are generally invisible and relatively cool when you are a few inches away from the leak. We believe that the adiabatic cooling is so rapid under this condition that this type of leak is relatively safer than similar leaks in other types of systems.

The purpose in our design was not economic gain *per se*. Having first defined the requirements of a classroom with respect to exterior heating and interior cooling, and the requirements of people for radiant heat control of their energy losses, this system was developed as a means of meeting these design criteria. The function of control of room environment is not to heat the building, but to control the rate of heat loss by the people occupying the space. We believe that this design approach consistently followed would result in improvement in the design of systems for control of environment.

John S. Blossom
Ziel-Blossom & Associates
Consulting Engineers
Cincinnati, Ohio

Some Statements Made in Fuel Oil Article Are Too All-Inclusive

I have read the article *Fuel Oil: What Every Heating Engineer Should Know* (December 1958), by Willie Hammer, with considerable interest and find that he does a very good job of explaining the fundamentals of heating with fuel oil.

However, I do take exception to a few of his statements which are too inclusive. Many of them are true in a general way, but as applied to different burners, they are not always accurate. For instance, the statement is made: "Cracked fuel oils sometimes do not burn as clean . . . . . as straight-run oils." A burner designed to burn cracked fuels can burn them every bit as clean as straight-run oils.

The answer to the question, "Is API gravity a reliable indicator of fuel oil characteristics?", is in the main accurate, but may be misleading. Even with oils from the same fields, the API gravity is of very little use in determining burning characteristics. We know that there are many indices that may denote burning characteristics of fuel oils, but viscosity is the most important one and API gravity is of no practical use.

The answer to the question concerning sulfur might be enlarged to show that many times deposits on heating surfaces are compounds containing sulfur. This is especially true if there is any metal in the oil, as is the case with many South American and Middle East oils.

In the question regarding the efficient combustion of fuels oils, the word *vaporization* is used. It is usually considered that an oil is vaporized from heat and a well-designed burner can be built to burn in the open or in a large combustion chamber without the use of heat. We therefore refer to the breaking up of the oil as *atomization* and not vaporization.

The question that can cause the most trouble, and usually does, results from statements like the one referring to the temperatures to which residual fuel oils should be heated. I maintain that it is impossible to give any definite figures such as Mr. Hammer gives.

In a properly designed air atomizing burner, No. 5

oil with a viscosity not greater than 350 Seconds Saybolt Universal at 100 F can be better burned cold than with even the slightest amount of heat added to it. However, if the No. 5 oil has a viscosity as high as 500 SSU, a temperature of around 100 to 130 F will make it burn better. However, these temperatures will be different when the oil is burned in a rotary cup burner, a high pressure atomizing burner, or a steam atomizing burner. Therefore an attempt to give specific temperatures for burning various oils, as is done in the Bureau of Mines Bulletin 466, causes a great deal of trouble because people use these figures with a burner that requires the oil to be at a different temperature whereas the temperature may be correct for another burner. This same argument is true with all oils in all burners and no attempt should be made to generalize on heating temperatures.

The question of normal viscosity of No. 5 oil should be answered at greater length, explaining that the figures given as a maximum of 40 SSF at 122 F is the Bureau of Standards' limit and, because there is such a great difference between the lowest and highest viscosities of No. 5 oil, it is necessary to divide these oils into those which must be heated and those that can be burned cold. A committee of the American Society for Testing Materials is now engaged in formulating revisions which we hope will include a revision of the specifications of No. 5 oil.

In answer to the question regarding additives, the writer makes the categorical statement that they reduce soot deposits and increase efficiency. I haven't been able to get any of the oil companies to admit this, and in my own experience have found that additives help in some places and do harm in others. If Mr. Hammer has found a formula or an additive that is good in all cases when burning heavy oils, I believe that he is the first one to have come up with the answer.

I have tried to point out that there is a danger in generalizing on this subject of fuel oils; that any general answers should state that different oils behave differently in different burners; that burner manufacturers' advice should be followed; and that fuel oils are so complicated that there are many characteristics that play important parts. Practical experience with any particular oil may show a generalized statement to be false.

J. V. Resek
President
Industrial Combustion, Inc.
Milwaukee, Wis.

The author's reply —

1) Cracked fuel oils may not burn as clean as straight run oils in their equipment. Many users do not know the type of oil they will be supplied and make no special provision for burning cracked oils.

2) API gravity may not be a reliable indicator. As indicated in the answer, fuel oils with the same API gravity may have different characteristics.

3) Regarding vaporization and atomization, the word "atomization" is in common use but I avoided it to forestall possible comment that the oil is actually not broken down into its constituent atoms, but instead it is vaporized.

4) The data presented in the article on heating and viscosity of No. 5 oil was rather general and Mr. Resek's comments expand them excellently. Various operators have commented to me in the past on the need or lack of need to preheat No. 5 oil. The most suitable temperature appears to be governed by the characteristics of each installation.

5) I must admit I have not found an additive which is good in all cases. The statement regarding increased efficiency is predicated on the fact that where soot deposits are reduced, heat transfer and absorption are improved.

Willie Hammer
Chief, Installations Branch
Hq, Ordnance Weapons Command
Rock Island Arsenal
Rock Island, Ill.

Economies of Built-up Ventilation Systems Don't Always Hold True

We refer to John H. Clarke's cost comparison of large central systems *vs* package systems for makeup air, as was given in his article, *Industrial Ventilation: How to Design for Heat Recovery* (November 1958). This article, as presented, is without doubt true, but implies that the conclusions hold true in all cases.

A central system may be the most economical if it is originally installed in a building to provide makeup air to original exhausters, such as roof ventilators.

Most makeup air is required in industrial buildings to equalize process exhaust and to eliminate negative pressures. Air brought into the building should at least equal that exhausted and must be heated to a temperature equal to that desired when exhaust fans are not operating.

1) If a comparison had been made using eight 20,000 cfm package units requiring 7½ hp motors, a distinct price advantage would show in favor of package equipment, with a bonus of 10,000 cfm.

2) Package units are flexible when used on 100 percent process makeup air. Central stations are not.

3) Package units can be relocated as requirements dictate. Central stations remain fixed.

4) As process exhaust increases, so does the need for makeup air. Rather than wait for a building to get 100,000 cfm out of balance, a plant engineer can make it up with package units as the need arises.

5) With proper coil arrangement in package units, the danger of losing substantial volumes of heated air due to possible coil failure is minimized.

6) Package units can be located with greater flexibility to accomplish their purpose, such as door heat-

ers with 100 percent makeup air; near source of exhaust, or for zone makeup.

With over 42 years of industrial fan application experience, we have found that it is a rare job that costs over 35c per cfm using package units installed.

R. J. Coughlin, Jr.
The R. J. Coughlin Co.
Detroit, Mich.

The author's reply — It is generally assumed that package air handling units provide less expensive installations than do central, built-up systems. It was the purpose of the cost comparison to show that this is not necessarily the case, particularly where large systems can be used and where the required duct distribution is extensive. The package units will usually be less expensive in initial cost for systems requiring little or no ductwork and where the alternative would be a built-up system of the same size. But beyond first cost, the operation and maintenance of these units must be considered. These tend to be excessive compared to built-up systems.

It is true that small package units can be moved, but this is a costly procedure where ductwork is concerned. It is also true that small additions in capacity are often a necessity in the growing plant and that package units tend to fit this picture. But they are not the only, or necessarily the better, answer. The importance of the system may dictate the need for a built-up system carefully designed for the specific supply air requirements; checked for performance, operated and maintained for minimum cost; and a system which will give long dependable service.

There are not many package air handling units which are designed so that reliable measurement of the delivered capacity is possible. For essential industrial supply air systems it is the delivered, rather than the catalog, capacity that counts. And the cost of any installation should be in terms of delivered capacity.

Mr. Coughlin states that the package units are more flexible when used with 100 percent process makeup air, but he doesn't state what the flexibility consists of. A built-up system can be designed for any required flexibility with equipment which is selected to do the job safely, reliably, and efficiently.

It is very doubtful that supply air capacity can be installed at Mr. Coughlin's figures where duct distribution is provided. Duct systems are frequently installed in today's plants in order to provide the multiple services of makeup, heating, cooling, and summer relief ventilation. The cost comparison in my article was based on such systems, operating at 2 in. static pressure. While smaller systems might have a lower static, say 1½ or 1¾ in., the 20,000 cfm air handling units suggested by Mr. Coughlin would require either overloaded 10 hp motors or, properly, 15 hp motors in lieu of the 7½ hp motors indicated.

In several plants I can think of where large volumes of makeup and relief air are required, there would be no room for small 15,000 or 20,000 cfm air handling units. The disturbing air flow from ductless air handling units could not be tolerated for either safe hood operation or for the process.

Package air handling units do have their uses, but they should not be oversold. Vendors would benefit greatly by studying the needs of modern plants and selling equipment carefully selected to do the required jobs. The sales potential is enormous, and the surface of this field has barely been scratched.

John H. Clarke
Engineering Design Supervisor
Air Conditioning and Power
Visking Co.
Div. of Union Carbide Corp.
Chicago, Ill.

Disagree That Same Odor Sources Are Present the Year 'Round

Albert B. Hubbard's discussion in *Round 4* of his *Winning the Air Conditioning Odor Fight* series (April) offers a masterful sleuthing of odors through the vagaries of season, temperature, humidity, and building level. His succinct treatment of these factors leaves nothing to be desired.

I question his assumption, however, that the "same . . . odor sources are presumably present the year 'round." Differences in body odors, amount and kind of food consumed (more hot food in winter, more body odor in summer), types of materials stored, and rate of putrefactive decomposition of organic matter (much higher in summer) may all be prime determinants of seasonal odor differences in a given space. They merit no less attention than the factors which Mr. Hubbard discusses, however.

Amos Turk
Consulting Chemist
Danbury, Conn.

Activated Charcoal Is Excellent Remedy for Most Odor Problems

Regarding Mr. Hubbard's *Round 4*, it is true that many of the troublesome odors occur in the summer. We can also have them at other times during the year. Odor problems can be very elusive and can originate for hundreds of reasons.

Fortunately there is an excellent remedy for most odor problems, including all of the common ones. This is the use of recirculation and purification by activated charcoal. Charcoal filters can be built into the ventilating system at the start or can be added in the form of filters or self-contained units to existing buildings.

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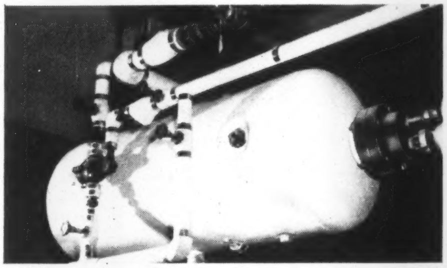

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question of the month

"What Causes Our Pipe Fittings to Fail?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with answers that have been received from readers. Other answers or comments for publication are invited.

> ***"On three occasions recently I have had to replace small bushings or nipples on my Schedule 40 low pressure steam lines because of an oxidation condition, entrained oxygen, or electrolysis. These failures have happened exclusively where bushings or nipples enter valves or fittings of dissimilar metals. The threads are eaten through and a buildup of iron oxide fills the inside of the worn-out part. My problem has been diagnosed by some as electrolysis and by others as oxidation.***
>
> ***"There are no electrical contacts with the piping which could cause the electrolytic action that has been blamed by some.***
>
> ***"I have had no trouble in condensate lines.***
>
> ***"Any information from others on how they have coped with a situation like this will be greatly appreciated."—J.B.S.***

Have Fluids Analyzed Chemically To Find Basis for Proper Treatment

J. B. S. DOES NOT indicate the source of boiler feedwater and its chemical properties or treatment, if any, before it enters the boiler. Water, as obtained from a natural source (lakes, ponds, rivers, etc.), contains air, oxygen, nitrogen, and carbon dioxide. These gases are normally present in the atmosphere and are in solution with the water. Need for removing or reducing their concentration for boiler feed and steam service is well known.

Dissolved oxygen can cause pitting and corrosion of boiler feed lines, boilers, and steam supply and return piping. If carbon dioxide is also present, the two gases acting simultaneously may be 5 to 50 percent more corrosive than for the same quantity of gases acting individually. Oxygen is approximately five to 10 times more corrosive than equal quantities of carbon dioxide, with temperature having a pronounced influence.

In the presence of moisture, ammonia is very corrosive to copper and copper bearing alloys. Pipe, tubing, fittings, and valves are prone to this type of corrosion. Liberation of ammonia may result from breakdown of nitrogenous matter subjected to boiler temperatures and the evolution of ammonia with steam.

Presence of carbon dioxide results from bicarbonate and carbonate alkalinity of the boiler makeup water. At boiler temperature, the bicarbonate and carbonate alkalinity undergo thermal decomposition, releasing carbon dioxide which becomes entrained with the steam.

Based on the data submitted by J. B. S., it is recommended that he follow these procedures:

1) Have a chemical analysis made of the makeup water. This should include pH, identification and concentration of soluble gases, and solids content.

2) Test condensate return water for the same properties.

3) Have a similar analysis made for the steam.

The tests should be performed by a water treatment chemist having specialized knowledge that will permit a complete analysis and competent recommendations for treatment. From these tests, it may be determined if the concentration of corrosive gases is excessive. If so, installation of a deaerator for their reduction and possible internal chemical treatment, such as sodium sulfite feed into the condensate, may be necessary.

H. B. WAYNE
Consulting Engineer
Woodhaven, N. Y.

Eliminate All Valves and Fittings of Dissimilar Metals; Install Deaerator

IT IS BELIEVED that galvanic corrosion is the major contributor causing bushings and nipples to deteriorate at valves or fittings of dissimilar metals.

When dissimilar metals having a mutual electrical

Replaced leaking valves with Crane gates
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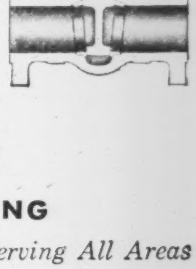
New gate valves, installed on steam lines to and from a fire-watch pump at a gasoline plant, leaked continually, almost from the day they were installed.

When frequent maintenance failed to stop the leaks, Crane steel wedge disc gates were installed. One valve was a 3-inch, 300-pound No. 33XR; the other one, a 4-inch, 150-pound No. 47XR—both rated for steam service at a maximum temperature of 850° F. Both valves have Exelloy discs and stems, and replaceable No. 49 Nickel Alloy, screwed-in body seat rings.

The switch to Crane valves was made two years ago. Since then, they have been in continuous operation. Not *one* leak has developed—and not *one* cent has been spent for maintenance.

Get the jump on your costly maintenance problems. Make original as well as replacement installations with Crane valves and other piping materials. For all facts about the many Crane valves used for refinery, pipeline and other services, see your Crane Representative or write to the address below.



Typical cross section of Crane steel wedge disc gate valves widely used in refinery, power and process services. Available in sizes up to 48 inches; for oil or oil vapor, steam, air, gas, gasoline, water and other services. In seven pressure classes—150-pound to 2500-pound, with temperatures to 1100°F. Choice of trim materials is most complete. Write for details.

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contact, such as a bushed valve, are exposed to an electrolyte, an electrical current flows from one metal to the other. This is called a galvanic current. In an iron-copper system, for example, the final deteriorated result is the combination of iron, oxygen, and water to give a hydrated iron oxide.

The electrolyte in J. B. S.'s case is condensate in the steam supply line which has pocketed at the fitting. The condensate is generally acidic because of its affinity for carbon dioxide present in the air voids of the steam distribution system.

The simplest way to remedy the situation is to eliminate all valves and fittings having dissimilar metals. Another method is to install a deaerator to eliminate absorbed carbon dioxide and oxygen in the condensate. The latter method is not absolute, particularly if the boiler is operated intermittently allowing air to fill voids normally occupied by steam.

R. J. Zablodil
Director
Thermodynamics Div.
U. S. Naval Civil Engineering
Research and Evaluation Laboratory
Port Hueneme, Calif.

READER ASKS —

"What Is a Plenum?"

"As a regular reader of Heating, Piping & Air Conditioning, I would like to ask the question: What is a plenum?

"All known codes are fairly consistent in agreeing that a plenum should conform to the standards of construction for ducts. Our building code, for example, refers to NBFU No. 90A, p. 9, para. 125 (a) '. . . . . . plenum chambers which conform to all the requirements for ducts may be located . . . .etc.'

"The reason for this statement is that a plenum is a duct and, more specifically, is part of a supply air duct system under pressure. By pressure is meant *above atmospheric* or positive static pressure.

"The 1958 ASHAE Guide defines a plenum as 'an air compartment maintained under pressure and connected to one or more distributing ducts.'

"This would be a correct definition if the term *pressure* used therein were defined as '*above atmospheric*.'

"The term plenum is an outgrowth of the systems wherein a blower delivered air (usually heated) into a concealed space in a building, such as an attic, enclosure under a theater mezzanine, basement, or underfloor chamber, and then to the conditioned spaces through vents or registers. Back when heating systems were more hazardous and were subject to dangerous fumes or inflammable gases, or where ammonia was used as a refrigerant, a building could fill with such gases. This would be a distinct hazard if the pores of the plenum were not sealed.

"Suppose an air handling unit with a fan, filter, cooling coil, motor, and drive is standing in a room containing nothing else. Does the fact that return air enters the room through one or more registers and flows to the unit make the condition hazardous? If the unit were in the corner of a large room, is the room itself a plenum and therefore hazardous? If wood is used throughout such a building, and the return air grille is wood, does that add to the hazard?

"The current definition of plenum in the building code for one major city is partially incorrect. It reads now: 'A plenum is an air compartment or chamber to which one or more ducts are connected and which forms part of either the supply or return system.'

"The NBFU No. 90A definition (June 1957, p. 3) states that a plenum is 'an air compartment or chamber to which one or more ducts are connected and which forms part of an air distribution system.'

"Neither the 1958 Guide nor the NBFU Pamphlet No. 90A refer to a 'duct collection system' or 'duct return system' but to the supply system, which is the distribution system and could conceivably distribute fumes or hazardous gases from faulty equipment.

"It is not impossible to use a 'return-air-duct-plenum duct system,' but such a system is rare and usually supplemented by a return air fan which would place it then under the same restrictions.

"I would appreciate hearing from others regarding this subject, including their interpretation of these definitions and if '*distribution*' means the supply air system and if '*pressure*' means *above atmospheric*. This definition so interpreted can save thousands of dollars."
—W.G.M.

• *YOU ARE INVITED to contribute a question for publication, or an answer to a published question. Please address your reply to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

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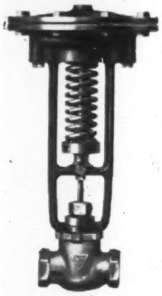

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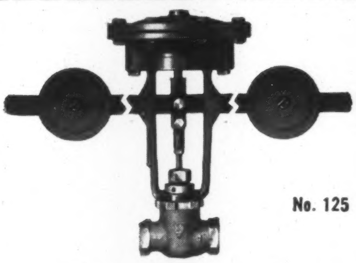

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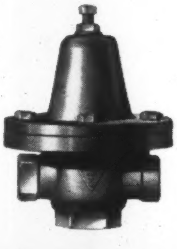

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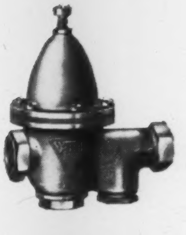

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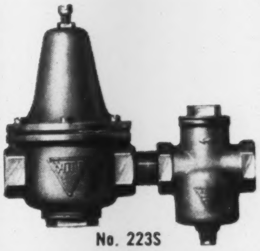

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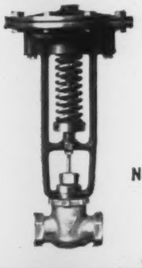

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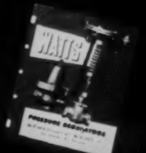

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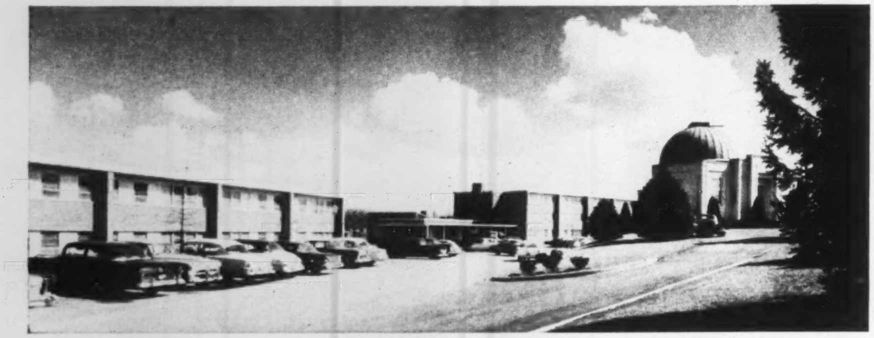

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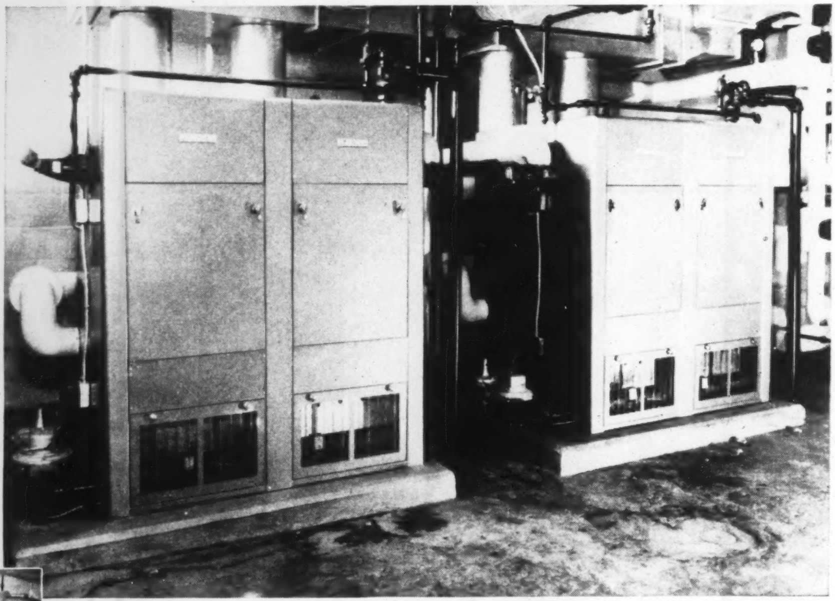

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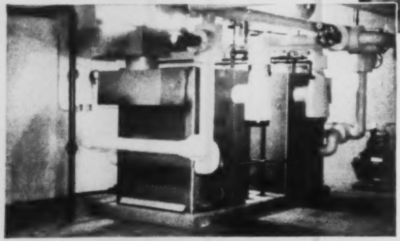

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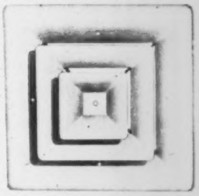

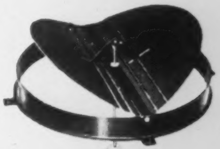

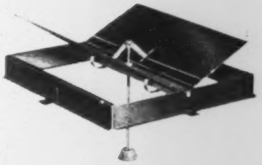

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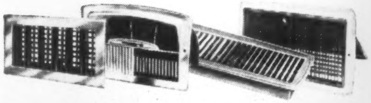

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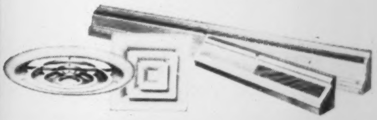

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Submarine studies indicate . . .

Airborne Condensation Droplets, Ions May Be Major Health Factors

. . . in habitability of closed spaces

BY KARL E. SCHAEFER
Head, Physiology Branch
U.S. Navy Medical Research Laboratory
New London, Conn.

● Prolonged submergence of today's submarine has made habitability an important factor in crew members' well-being. Some of the problems have been solved, but investigation into the effects of condensation droplets and positive and negative ions has revealed that these may have an effect on respiration—and hence morale and efficiency—of personnel. Things got so hot for Germany's U-boat fleet during World War II that these studies became necessary. Droplets and ions were measured in the atmosphere of fleet type submarines and were found significantly increased during periods of submergence. The data presented here, of course, goes beyond submarines. It would apply to any occupied closed structure housing ion generating materials. This is the first time that this information has been made available in the U.S.

Dr. Schaefer, born in Germany, received his M.D. from the University of Kiel in 1936. During the war he conducted physiological studies at the German Research Institute of Submarine Medicine in Carnac, France. After the war he taught physiology at the University of Heidelberg and served as acting director of the Physiological Institute from 1947 to 1949, editing the German Monograph on Submarine Medicine prepared under the auspices of the U. S. Naval Technical Unit. In 1949 he joined the U. S. Navy Medical Research Laboratory. Dr. Schaefer was instrumental in preparing the program for the First International Symposium on Submarine and Space Medicine, held last September in New London, Conn. He was nominated to become a member of the Armed Forces-NRC Committee on Bio-Astronautics last December.

▶ ▶ ▶

With the advent of nuclear energy, the submarine of today is able to live up to its name. Periods of submergence are now seemingly limitless. No longer must these vessels spend most of their time on the surface generating power. But with this technologic advancement has come a new problem—environment for crew members for these extended periods.

Particular attention must be given to all environmental factors. The composition of the submarine atmosphere to which the crews are continuously exposed must be known in greater detail than before. Impairing effects of prolonged exposure to high carbon dioxide concentrations have been recognized, and the atmospheric control equipment used in modern submarines can maintain these concentrations below the tolerance limits set for long submerged periods and provide adequate supplies of oxygen.

Still other components of the submarine atmosphere which have escaped attention in the past are gaining increased significance. Among these are (1) trace substances, (2) condensation droplets, and (3) positive or negative ions.

Many *trace substances* have been determined both in fleet type submarines and in nuclear-powered submarines. They differ in the various compartments, depending on the equipment used. In German submarines during World War II, trace substances like ammonium compounds and nitrites did not reach toxic levels, but exceeded in some circumstances the irritation threshold[1]. These values were, however, obtained under conditions of short submerged periods of up to one day. No data has been published on conditions of chronic exposure.

Condensation droplets or condensation nuclei are small particles in the atmosphere on which water can condense if the humidity is high enough. The particle diameters of these droplets lie between 0.001 to 10 microns. Condensation droplets represent aggregates of molecules, and their physiological significance is associated with their retention in the respiratory tract.

About 47 to 90 percent of the airborne droplets are removed from the air in inhalation[2]. The condensation nuclei increase the water condensation in the respiratory tract which in turn will facilitate the precipitation of particles and impurities of the air. Thus, toxic substances, which might be in the air in sub-threshold concentration, could be concentrated in the condensed water droplets and reach toxic concentrations when precipitated with the water droplets.

About 50 percent of the droplets carry an electrical charge[3]. If the aggregate of molecules or particles contained in the droplet has a surplus of electrons, it is called unipolar negative aerosol. If a deficiency of electrons exists, it is referred to as a positive aerosol. (Condensation droplets must be differentiated from gas ions, which are smaller and consist of single molecules (or atoms) with an electrical charge.)

By means of an electrical field, positive and negative ions can be separated from the air and counted. Ions have been classified[4] as follows:

1) *Small ions* of molecule size (gas ions) with speeds of 1 or 2 cm per sec/volts per cm in the electrical field.

2) *Medium size ions* with speeds of 0.02 or 0.01 cm per sec/volts per cm.

3) *Large ions* (large slow moving particles or water droplets carrying electrical charges with a speed of 0.0005 cm per sec/volts per cm. Condensation droplets with electrical charges would fall in this class.

A normal atmosphere contains a mixture of all ions, and these have speeds inversely proportional to their sizes[5].

Ionization Caused by Cosmic Rays

Ionization of the atmosphere is produced by cosmic rays and radiation from radioactive particles in the air and in the soil. Gamma radiation appears to be the principle cause of air ionization since the earth's crust absorbs the alpha and beta emission of the radioactive elements[6].

In general, less than 1000 small ions are found in a cubic centimeter of air, and the number of positive ions is usually slightly greater than that of the small negative ions. The ion content of the air is influenced by barometric pressure, temperature, humidity, locality, and elevation. Humidity, for instance, shows an inverse relationship to ionization[7].

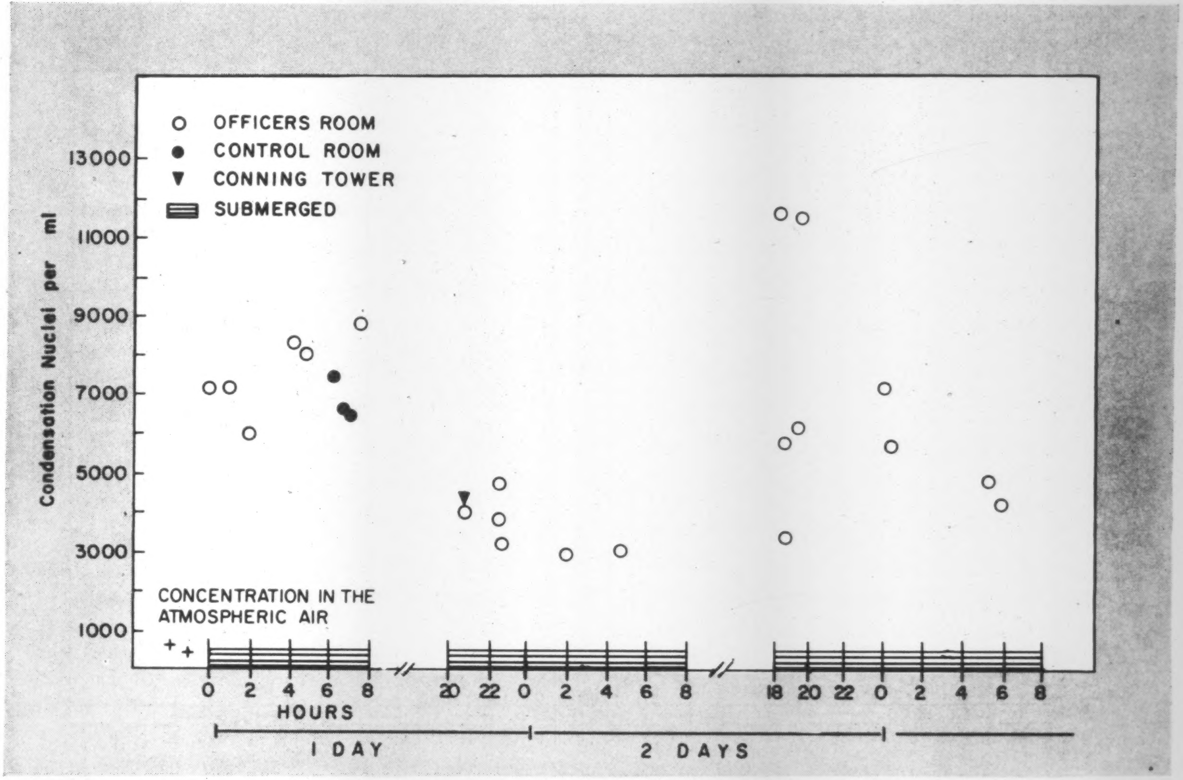
What Are Biological Effects of Ions?

Earlier studies of the biological effects of negative and positive ions produced contradictory results—probably because of differences in experimental procedures of the different investigators and the lack of adequate ion generators. But in recent years a number of significant contributions have been made. It appears now more generally accepted that positive ions may exert harmful effects, while negative ions may have beneficial effects on the organism.

Negative ions produce relief, in certain cases, from hay fever and asthma[8]. Positive ions appear to cause stopped-up noses, dryness of the mucous membranes, and headaches[9,10]. It has been demonstrated, in the fresh rabbit trachea, that the pulmonary clearing mechanism is directly affected by ionization of the air[11]. The rate of the movements of the ciliae as well as the mucous flow were

TABLE 1 — INCIDENCE of condensation droplets collected in submarine prior to and during submergence indicates significant increase in number of droplets when boat is submerged

Location	Droplets per cc
Near the coast	about 1000
In the atmosphere on the upper deck of the submarine (Baltic Sea)	500 to 600
Atmosphere in the submerged submarine	3000 to 11,000
Submarine atmosphere	4000 to 28,000 (higher figures when smoke is forced back)
Any typical large city	about 100,000



1 CONCENTRATION OF ATMOSPHERIC condensation nuclei in various rooms of a submerged submarine (3000 to 11,000 per cc) are compared with 500 to 600 per cc in atmospheric air outside submarine. Milliliters in above illustration are same as cubic centimeters referred to here and in text

significantly reduced by positive ionization, and the reverse effects were noticed with negative ionization.

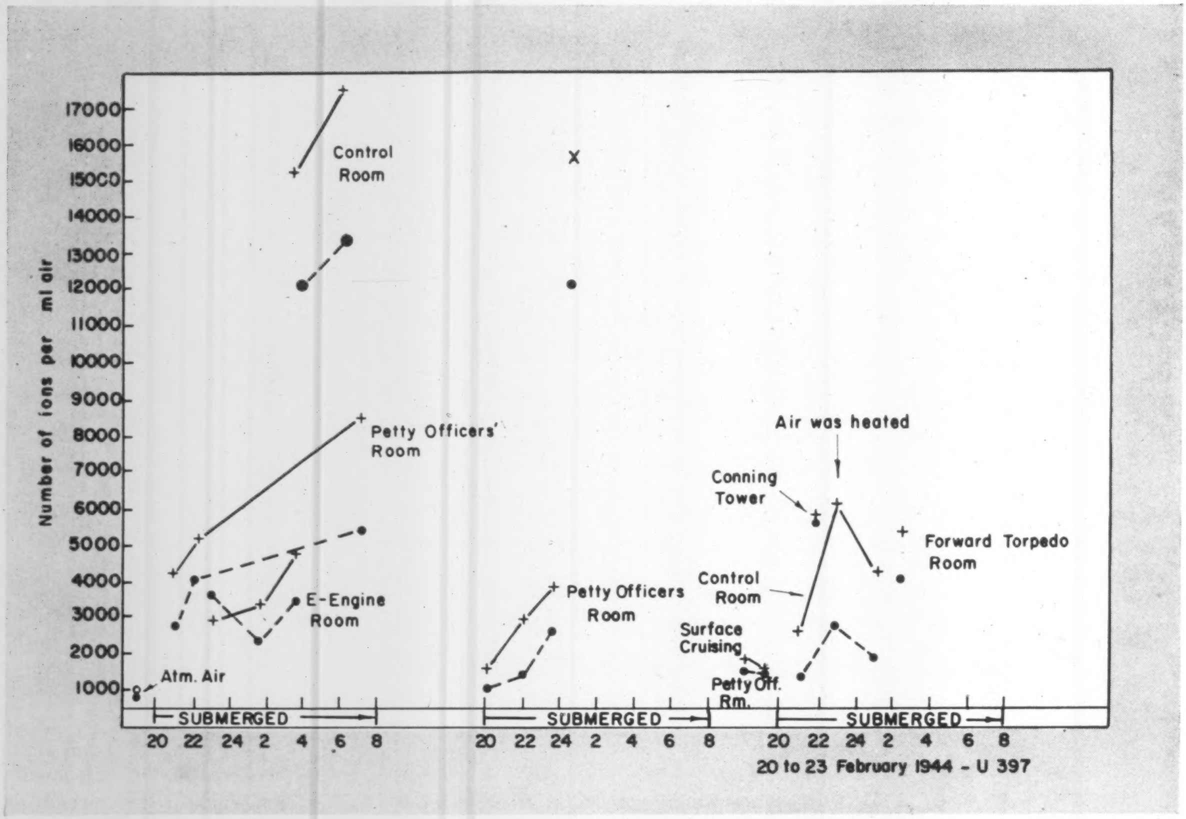
There are indications that ionized air may have a far-reaching influence on biological systems. Positive ions reduce the succinoxidase content of the rat adrenal gland[12]. An increase in the CO_2 combining power of blood plasma of male hamsters exposed to negative ions has also been reported[13]. These findings seem to point out that the basic mechanisms of ion effects are connected with enzymatic changes. The therapeutic effects of certain spas like Bad-Gastein, Germany, have been attributed to the presence of negative ions among other factors[14].

On the other hand, detrimental effects of strong atmospheric disturbances are supposedly caused by an excess of positive ions in the air[15]. An excess of positive ions produces a "stuffy feeling" in a room, and 5×10^4 negative ions per cubic centimeter are sufficient to remove this effect[16].

Studies[5] have produced evidence that the addition of negative ions improved the comfort in air conditioned rooms. As a consequence, electrostatic ion generators are now standard components of some air conditioning units.

TABLE 2 — SECOND SERIES of ion measurements was taken in closed submarine to simulate submergence. Light ions, heavy ions were measured separately. Note greatest increase in number of ions in control room

Compartment	Time	Light ions per cc		Heavy ions per cc		Compartment temperature, F	Relative humidity, percent
		Negative	Positive	Negative	Positive		
Forward torpedo room	10:45 p.m.	10,600	6,240	70,000	57,800	...	..
Control room	10:45 p.m.	775	900	3,590	6,800	64.0	86
	1:53 a.m.	9,950	9,100	39,000	24,800	62.7	87
	3:45 a.m.	13,700	13,700	68,200	91,000	62.3	86
	5:45 a.m.	13,700	12,200	63,500	82,800	62.3	88
Diesel engine room	Midnight	1,030	1,050	6,850	8,050	72.6	61
	1:25 a.m.	3,200	3,400	13,600	10,500	71.6	63
	4:05 a.m.	3,780	4,550	21,000	10,900	69.8	67
	5:18 a.m.	4,760	3,660	17,000	12,400	69.4	66
Warrant officers' quarters	2:10 a.m.	4,960	4,370	18,200	22,700	68.0	83
	3:15 a.m.	4,220	5,220	18,200	24,800	68.0	76
	6:00 a.m.	4,570	6,850	19,500	37,400	65.3	78



2 CHANGES IN NUMBER of positive and negative ions in atmosphere of a submarine during submergence as time elapses are as depicted here. Milliliters in above illustration are same as cubic centimeters referred to in text

Some basic investigations[17,18] were made back in the 1930's. Although they revealed that artificial ionization exerted a "normalizing" influence on the human organism, they did not lead the investigators to believe that these effects were so highly significant as to warrant the use of artificial ionization for general ventilation.

This short survey indicates that ionization of the air *is* of physiological significance and that abundance of air in confined spaces can play an important role for the well-being and performance of personnel.

Ions Increase During Submergence

The data given herein deals with measurements of condensation droplets and ionization patterns on World War II German submarines which correspond to the U. S. Navy fleet-type submarines of that time. It was found that during submergence the number of condensation droplets and the number of ions—predominantly positive—increased. It was further established that gamma radiation from the radioactive dials caused the ion formation. Inasmuch as today's nuclear powered submarines have a constant source of radiation under submergence, the conditions under submergence in respect to formation of air ions should be very similar to those under which these former measurements were made[19].

In gathering this data, two series of investigations were conducted, one during a three day experimental cruise in the Baltic Sea and the other in a submarine completely closed to imitate the submerged conditions. The second series was conducted jointly with Dr. Dreblow from the Kaiser Wilhelm Institute of Biophysics at Frankfurt. Various equipment was used in counting and measuring condensation droplets and ions.

Data on the incidence of condensation droplets collected in a submarine prior to and during submergence is presented in Table 1 and Fig. 1. Control measurements of condensation droplets contained in the atmosphere on the coast gave values of about 1000 per cc. Only half of this amount was found on the upper deck of the submarine when surfaced. During submergence the number of condensation droplets increased significantly (3000 to 11,000 per cc).

Results of the first series of measurements on the incidence of positive and negative ions during the Baltic cruise are given in Fig. 2. The values represent small and medium ions up to mobility 0.05 cm per sec. During surface cruising, 1500 and 2000 ions per cc were found, slightly more than half of which were positive. (This is a small increase in comparison to inland air in towns which contains about 1000 ions per cc.) During submerged cruising, the number of ions in the submarine compartments continuously increased, the positive ions more than the negative ones. In isolated cases, values of 15,000 and 17,400 ions per cc were found.

Higher Temperatures Decrease Ions

Fig. 2 shows a continuous increase of the ions in all submarine compartments during submergence. In cooler rooms, higher quantities of ions were found. These findings indicated that the difference of the ion content of the various submarine compartments is to a certain extent influenced by the temperature of the air. To prove this, the temperature in the control room was raised. The result was a decrease in the number of ions.

It is difficult to determine how the measurement was influenced by local air currents produced by ventilation or by vapor pressure changes due to increased condensation water on the cold hull. It is likely that the change of the water content of the air played a major role, since humidity and ion content have an inverse relationship[7].

The second series of investigations of the ion content in the submarines was conducted with a different ion counter. This allowed separate measurement of small ions (with speeds up to 0.05 cm per sec/volts per cm) and large ions (with speeds up to 0.0075 cm per sec/volts per cm). Data is shown in Table 2 and represents mean values of five different measurements. In three compartments, repeated determinations were carried out over periods extending up to seven hours after the submarine was closed. (In this way submergence was simulated since a cruise could not be made at that time because of continuous air raids.)

Values of the small ions in the control room ranged from 775 to 13,700 for negative and 900 to 13,700 for positive. These findings agree well with the previous findings obtained with another ion counter, which ranged from 1000 to 17,400. Both instruments measured ions with speeds up to 0.05 cm per sec/volts per cm.

Greatest Increase in Submarine Control Room

The greatest increase in small ions during simulated submergence was found in the control room. In the diesel engine room the rise was much smaller, while in the warrant officers' quarters the small negative ions remained unchanged and the positive ions increased slightly. The second series of measurements did not show a marked preponderance of positive ions as far as the small ions were concerned. The large ions (with speeds up to 0.0075 cm per sec/volts per cm) included also some medium size ions. The greatest increase in large ions during simulated submergence was also noted in the control room.

The majority of the large ions in the control room and the warrant officers' quarters were positive, while the negative ions exceeded the positive in the diesel engine room. The latter compartment showed the smallest number of small and large ions. This might be attributed to the higher room temperature, since it had been shown in the first series of studies that increased heat reduced the number of ions. The results, so far, demonstrated clearly that the number of ions increased during submergence in closed spaces.

Since, under normal conditions, ions are rapidly removed from a closed room when several people are present[20,21,22,23], one had to conclude that a source of radiation was on the submarine which produced ions continuously. This lead to the measurement of gamma radiation. But that's another story—which will appear in an early issue. ‡

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Temperature Drop Is an Important In Choosing Most Economical Hot Water

Low, intermediate, and high temperature hot water heating system operating temperatures and design temperature drops have a definite bearing on the selection of the most economical design for each application. Mr. Carlson tells how increased temperature drop can decrease the pipe size, what factors to consider, and how control of the systems becomes more critical as the temperature is increased.

VARIOUS OPINIONS exist concerning some general differences between high temperature and lower temperature hot water systems, G. F. Carlson, Bell & Gossett Co., told those attending a recent heating, air conditioning and refrigeration conference in Milwaukee, sponsored by Marquette University. His discussion applied to overall economics and to other design factors requiring design care.

Mr. Carlson said that the differences between these systems are determined primarily by system operating temperatures and design temperature drop. He defined the three general systems in terms of temperature as follows:

1) *Low temperature hot water (LTHW)*: A hot water system operating within ASME Low Pressure Boiler Code limitations, i.e., at less than 250 F and not exceeding 160 psig. Standard equipment is used. Design temperature drops up to 50 F deg are used.

2) *Intermediate temperature hot water (ITHW)*: A hot water system operating in the neighborhood of 300 F, with required anti-boiling pressure and which uses standard or "modified standard" equipment. Design temperature drops from 50 to 100 F deg are used.

3) *High temperature hot water (HTHW)*: A hot water system operating at temperatures in the neighborhood of 400 F, with required anti-boiling pressures and which generally requires special equipment.

Engineer Establishes System Economics

In a large sense the engineer establishes general system economics and the overall design problem by his selection of the system design temperature drop, he said. Design temperature drop is the difference between supply water temperature and return water temperature at design load conditions. It is an engineering yardstick used to measure the amount of heat carried by water.

The amount of heat carried by water depends on the rate of flow, the specific heat of the water, and the system temperature drop. These factors are related as follows:

Heat carrying ability (Btu per hr) = water flow rate (lb per hr) × specific heat × system temperature drop (F deg).

(Water flow in lb per hr can, of course, be changed to gpm by suitable conversion factors.)

The above relationship states that the same amount of heat, at design conditions can be carried in a 100 F deg temperature drop (T.D.) system as in a 20 F deg temperature drop system. The 100 F deg temperature drop system will only require one-fifth the flow needed for the 20 F deg temperature drop system, according to Mr. Carlson.

Design temperature drop directly affects system design flow rates. Economically speaking, it therefore directly affects pipe size and pump size. (It also has other effects which he described in his presentation.)

Increased Temperature Drop Decreases Pipe Size

It can be generally stated that each time temperature drop is doubled, a decrease of about one pipe size will be obtained — and the pumping horsepower will be cut in half. This statement is generally, *but not always*, specifically true, he emphasized.

To illustrate the general effects of increased design temperature drop on pipe and pump size, Mr. Carlson cited a series of specific system design examples. The designs were similar, except for design temperature drop. Design temperature drops compared were: 20, 50, 100, and 200 F deg.

His design example was eight 3-story buildings with 20 dwelling units each. Heat loss for each building was estimated at 630,000 Btu per hr. A central boiler plant was used. Continuously circulating primary mains served either direct connected secondary circuits or intermediate water-to-water heat transfer units to provide individual heat control for each building.

The plot plan, primary main sizes, and primary pump sizes are illustrated in Fig. 1.

Design Yardstick Heating System

Striking reductions in both primary main pipe size and primary main pump size are illustrated. For example, the 20 F deg temperature drop system requires a 4 in. line leaving the boiler room. The 100 F deg temperature drop system only needs a 2½ in. pipe. At the same time, installed pump horsepower selections have dropped from two 3 hp base mounted pumps to two ¾ hp line mounted units.

Size advantages of the higher design temperature drop system are dramatic, Mr. Carlson stated. A very simple evaluation, however, indicates that the "law of diminishing economic returns" applies to the use of increased design temperature drop, he said.

To assist in this evaluation, the following data on pump sizes, horsepower, and pounds of primary main piping was presented:

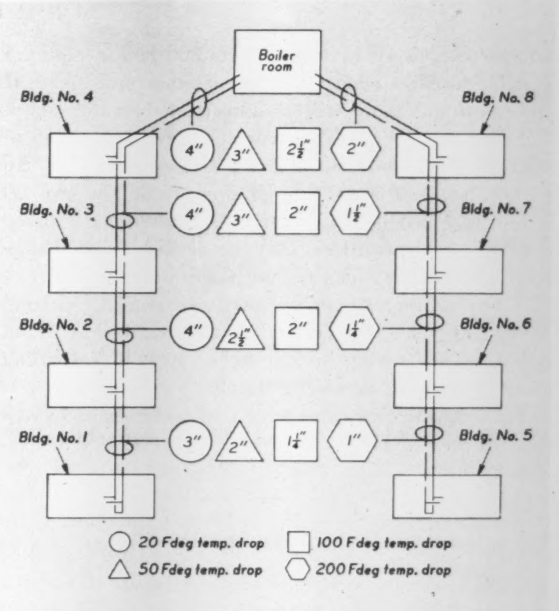
System design temperature drop, F deg	Pumps (number and horsepower)	Pump horsepower saved by increased temperature drop	Piping, approximate weight, lb	Piping saved by increased temperature drop, lb
20	Two 3 hp base mounted	—	28,000 (Sch. 40)	—
50	Two 1½ hp base mounted	3	16,200 (Sch. 40)	11,800
100	Two ¾ hp line mounted	1½	10,800 (Sch. 40)	5,400
200	One ¾ hp	¾	7,600 (Sch. 40)	3,200
200*	One ¾ hp base mounted and special	¾	9,800 (Sch. 80)	1,000

*A 200 F deg temperature drop system will operate as HTHW. HTHW systems are designed using Schedule 80 pipe.

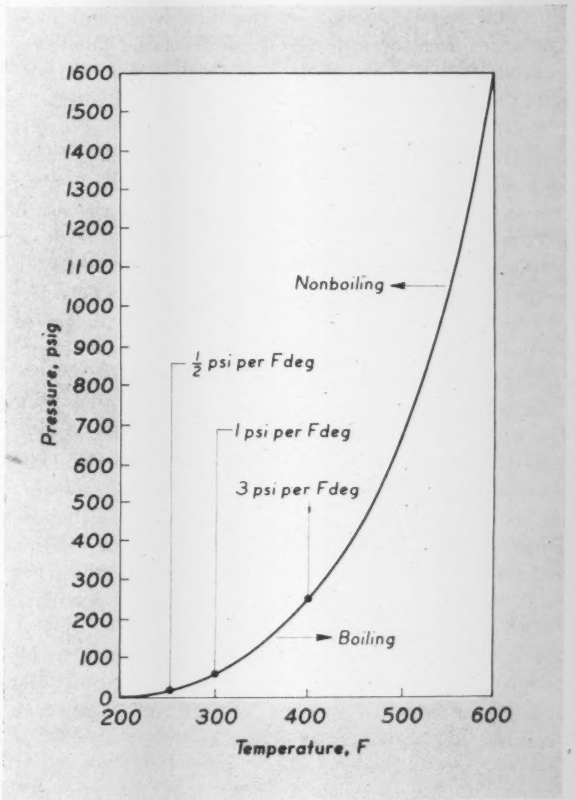
The weight of piping used for each design temperature drop is shown to comparatively illustrate overall system pipe size change with changing design temperature drop. It would seem that cost of the piping installation — aside from the fixed cost of trenching, but considering fitting, hanging, and insulating — would bear a rough relationship to the total pounds of piping used. Cost variation of valves with different pressure ratings should be considered separately.

For the particular system described, these general conclusions can be reached, he said:

1) For an increased design temperature drop from 20 to 50 F deg, an approximate pump size saving of 3 hp



1 PLOT PLAN of eight 3-story buildings heated from central boiler room shows effect of increased temperature drop on pipe and pump sizes. Note striking reductions for primary mains at greater temperature drops



2 SYSTEMS OPERATING at 300 F are usually controlled by temperature responsive controls. Difference, requiring greater control for ITHW system, is illustrated here. Note that for each degree rise in temperature, ITHW system requires about twice increased pressure needed by LTHW system and the costs saved by installing 11,800 lb less pipe are available to offset additional costs or other problems that might occur due to the increased design temperature drop.

2) For an increased design temperature drop of 50 to 100 F deg, an approximate pump size saving of 1½ hp is indicated, and 5400 lb of pipe is saved. The cost reduction obtained is available to offset additional expense or other problems which may be caused by a change from a 50 to 100 F deg design temperature drop.

3) For an increase in design temperature drop from 100 to 200 F deg, the saving in pump size will be about ¾ hp and the saving in pipe about 1000 lb (assuming Schedule 80 pipe is used). Resulting cost reduction is available to offset other possible cost increases and problems which may be caused by the increased design temperature drop.

Weigh Additional Costs, Design Problems

Mr. Carlson next evaluated additional costs and design problems which may be caused by increased design temperature drops. At the present time, the 20 F deg temperature drop system is the generally accepted "conventional" hot water system, he said. Historically, the system was developed because of objections to the "conventional" gravity system of yesteryear. These objections were slow system response to changing load conditions, plus a requirement for uneconomically large pipe sizes and radiation. The use of forced circulation provided economic advantages, plus faster system response times.

Those concerned with the introduction of forced circulation hot water systems used a 20 F deg temperature drop design base for several reasons. Initially, forced circulation was generally limited to smaller systems. It was recognized that the use of design temperature drops greater than 20 F deg has little economic merit on smaller systems. The need for built-in design safety factors and for simple design procedures was also recognized because initially hot water system design was not generally carried out in engineering offices.

Certainly one of the reasons for selection of a 20 F deg temperature drop design base was because, at this, each gallon per minute circulated provides about 10,000 Btu per hr heat loss — a good round number allowing simple design, he stated. This design base was not intended to be inflexible; its originators recognized design temperature drop for what it is — a design tool. They made use of it in such a way as to provide maximum design ease and design safety factors.

The system allows the engineer much latitude in his design and permits simple trouble-free operation, said Mr. Carlson. It often operates "in spite of" rather than "because of" the particular design procedure used.

"Conventional" System Has Good Safety Factor

What are the design safety factors of the 20 F deg temperature drop system, and how do these compare with higher T.D. systems? One design safety factor of the conventional 20 F deg system is based on design supply water temperature. These systems almost always operate within the framework of the ASME Low Pressure Boiler Code (at a temperature less than 250 F and at pressures less than 160 psig).

The "conventional" system, operating with supply water temperature in the neighborhood of 210 F, has considerable "temperature reserve" safety factor, providing sufficient boiler capacity is available. This is because supply water temperature can be increased to 250 F if required. An increase in water temperature will, of course, increase radiation and heat transfer ability. This is the true safety factor — the ability to provide for beyond design heat loads, he stated.

In general, as design temperature drop is increased, design supply water temperature is increased. A 50 F deg temperature drop system, operating within the ASME Low Pressure Code limitation and designed for the same mean system water temperature, will provide less "temperature reserve" safety factor. The same is true, of course, as design supply water temperature is increased on the 20 F deg system in order to reduce heat transfer equipment size. Systems designed for 100 to 200 F deg drops are usually operated at temperatures which preclude "temperature reserve." This, Mr. Carlson said, is because of temperature-pressure relationships, a subject which he discussed later.

How important is the "temperature reserve" safety factor? It might be argued that all design conditions are seldom experienced at the same time. Supplementary heat gains in the structure — such as caused by people, cooking, domestic water, chimney, exposed piping, sun, and wall stored heat — are not usually taken into account in our heat loss calculations and can be an appreciable amount of the total heat input. If so, they constitute increased safety factors and may offset the apparent advantage of the system "temperature increase" safety factor. How much and how reliable are supplementary heat gains are difficult questions to answer, he said, and until the amount and reliability of these gains are established they should be disregarded.

Control More Critical at High Temperatures

Both the 20 and 50 F deg temperature drop hot water systems are usually operated as LTHW systems (within ASME Low Pressure Boiler Code limitations). The systems can be operated using only periodic, unskilled "pushbutton" attendance because there are no critical temperature-pressure control problems.

Temperature-pressure control must be examined more critically as system temperatures are raised to provide for higher design temperature drops as it is more critical as higher temperatures are reached. Pressure must always be sufficient to keep boiling from occurring in any part of the system. Water boiling in the system piping will cause lack of water flow and stoppage of heat delivery — a condition to be guarded against most on elevated piping. Water boiling (cavitation) at the pump will also cause flow reduction and can seriously damage the pump.

It is extremely important to insure control of system pressure changes caused by pump operation, Mr. Carlson stressed. This problem has been simply solved on LTHW systems by proper pump and compression interrelationships; by pumping "away from" the compression tank connection to the system. This normally means pumping "away from" the boiler. The same consideration applies regardless of system operating temperatures, design temperature drops, or methods of pressurization. The pump should always discharge away from steam drums, nitrogen pressurization tanks, or open tanks so that system pressures are not decreased to below the boiling point because of pressure changes caused by pump operation. The majority of system pressure difficulties encountered in the past on LTHW systems will be avoided by proper pump location, he said. Proper pump location will help guard against these same troubles for higher design temperature systems.

The temperature-pressure relationship for water is shown in Fig. 2. For each degree of temperature rise, an increased pressure of approximately ½ psi is needed to prevent boiling when operation is at less than 250 F (LTHW). In the neighborhood of 300 F (IHTW) design supply water temperature, each degree of temperature rise requires about 1 psi increased pressure to prevent boiling. For systems operating in the neighborhood of 400 F (HTHW), each degree of temperature rise requires about 3 psi more pressure to prevent boiling.

LTHW System Easy to Control

Temperature-pressure control for the LTHW system is very simply and adequately applied by use of compression tanks and temperature responsive controls. Temperature-pressure control is seldom thought of as a problem because inherent temperature over-ride protection is normally very high — in the order of 40 F and over. Because of the temperature-pressure relationship, a given system pressure increase caused by pump operation provides more anti-boiling protection for the LTHW system than for higher design temperature systems, he stated.

Compression tank selection procedures are well defined for the 20 F deg temperature drop LTHW system. Temperature differences between supply and return piping are not enough to really influence tank selection or system operating problems. Tank size selection for the 50 F deg drop constant supply water temperature system should take into account differences between supply and return water temperatures as caused by load conditions.

Aside from some additional care in tank selection, there is little temperature-pressure control difference between the 20 F deg drop and 50 F deg drop LTHW systems. Inherent "thermal over-ride" anti-boiling protection is high for both systems because of the temperature-pressure relationship for system operation at 250 F and below, said Mr. Carlson.

The 100 F deg temperature drop ITHW system operating in the neighborhood of 300 F design temperature requires that increased care be taken in terms of temperature-pressure control.

Systems operating in the range of 300 F are usually controlled by temperature responsive controls — in the same way LTHW systems are controlled. The difference, requiring greater care for the ITHW system, is illustrated in Fig. 2: for each degree rise in temperature, the ITHW system requires about twice the increased pressure needed by the LTHW system. In other words, for the same amount of anti-boiling pressurization the ITHW system will only provide about half the "temperature over-ride" protection afforded by the LTHW system. Since temperature responsive controls require response time due to "thermal lag," the difference is important, he said.

This difference is very easily compensated for by increasing design operating pressure. Water at 300 F requires that its pressure be lowered to about 52.3 psig before it will boil. Design pressures in the neighborhood of 100 to 125 psig will still permit use of standard equipment and will provide about the same degree of "temperature over-ride" protection afforded LTHW systems.

Compression Tanks Pressurize ITHW Systems

Pressurization of the ITHW system usually is provided for by compression tanks. Compression tank size selection for the ITHW system should take into account differences in system water volume due to changing loads. For systems operating with constant supply water temperatures, it is important to remember that, at low loads, return water temperature will approximate supply water temperature. Maximum water expansion volumes and system pressures will occur. The tank should be sized so that relief valve operation does not occur for this condition. At the same time, it must be considered that design loads will reduce return water temperatures, consequently reducing system pressures and anti-boiling pressurization. The tank must be sized so that water boiling cannot possibly occur at design load operation, Mr. Carlson emphasized. Tank size should be considered for both conditions of operation.

Constant pressurization, using nitrogen at high pressures, is sometimes employed — apparently because of the variations in system water volume due to load. Nitrogen is added to or withdrawn from the tank as required to maintain relatively constant pressure. Somewhat complicated arrangements are provided to allow re-use of the nitrogen.

Temperature-pressure control for the ITHW system can be summarized as being somewhat more critical than for the LTHW system. In general, the problem is solved by simply increasing design operating pressures, he said. The increase in design operating pressure need not exceed pressure limitations for most standard readily available equipment for pressures 125 psig to 150 psig.

Mr. Carlson next discussed the HTHW system and stressed the importance of excellent temperature-pressure control in the successful operation of this system. This discussion will appear in an early issue. ‡

Sectional Committee Interprets Code for Pressure Piping

SINCE the Code for Pressure Piping, ASA B31.1-1955, was last issued, the Sectional Committee on the Code has been asked to interpret various statements contained therein. While these Cases represent the opinion of the committee, they will not become parts of the Code until formal actions have been taken. Among the subjects covered in these Cases are: stainless steel piping materials for nuclear energy installations, tensile strengths of piping materials for various applications, safety of piping materials when short-time variations of pressure and temperature are encountered, where modular cast iron may be used, and if reinforced concrete pipe can be used for certain applications under Section 1 of the Code.

Case No. 17

This case, as published on pages 100-101 in the March 1955 issue, has been annulled because the material discussed therein, as not being included in Table 1 of the Code, will now be handled by each code section individually.

Case No. 26

This case, which appeared in the November 1957 issue on page 141, has been re-opened with modifications. These changes are shown in *italics*.

Inquiry: May Types 304 and 304L grades of stainless steel be used for piping *of aqueous type reactors* in nuclear energy installations under the rules of Section 1 of the Code for Pressure Piping?

Reply: It is the opinion of the committee that Types 304 and 304L stainless steels may be used in nuclear energy installations for construction under Section 1, provided the following conditions are observed:

1) The materials shall at least conform to one of the following specifications:

Pipe	A376 A358
Welding fittings	ASTM A403
Forgings	ASTM A182

The minimum carbon content of Type 304 material and the maximum carbon content of Type 304L material shall be 0.035 percent by check analysis.

2) *If welding is employed, all welds shall be inspected as follows:*

a) *All longitudinal welds shall be fully radiographed.*

b) *All circumferential welds shall be fully radiographed wherever possible.*

c) *Where the size or configuration of the weld does not permit radiographing, it shall be examined by the fluid penetrant method.*

d) *Provisions* (a) *through* (c) *do not apply for services at or near the ordinary range of atmospheric temperatures, where these materials are employed primarily for their corrosion resistance, provided the piping is hydrostatically tested at* $1\frac{1}{2}$ *times the maximum allowable working pressure for the piping used.*

3) The design temperature shall not exceed 800 F.

4) The allowable stress values for seamless materials shall be as follows:

Temperature, F	Type 304	Type 304L
—20 to 100	18,750	17,500
to 200	16,650	17,000
to 300	15,000	13,400
to 400	13,650	11,000
to 500	12,500	9,700
to 600	11,600	9,000
to 650	11,200	8,750
to 700	10,800	8,500
to 750	10,400	8,300
to 800	10,000	8,100

Note: These stress values do NOT include joint efficiency or quality factors.

5) A joint factor of 0.95 shall be applied to welded construction that has been fully radiographed.

Case No. 28

This case, as published on page 141 in the November 1957 issue, has been annulled because the material contained therein has been included in the latest edition of ASA B16.5.

Case No. 33

Inquiry: May pipe conforming to API Specification 5LX be used under the rules of Section 3 of ASA B31?

Reply: It is the opinion of the committee that pipe meeting Grades X42 and X52 of Specification API 5LX is permitted for use at a metal temperature not to exceed 300 F in refineries under Division A piping with the limitation that this pipe is not to be used in hydrocarbon service within process unit limits.

The allowable stress values, in pounds per square inch, for the pipe shall be:

S, psi, for metal temperatures in not to exceed; Grade	100 F	200 F	300 F
5LX42	20,000	19,000	18,200
5LX52	22,000	21,000	20,000

The following weld joint factors are to be appropriately applied to the stresses given:

Weld joint factor *E* Type of joint	Basic *E* factor
1) Arc or gas weld	
a) Double welded butt, as welded	0.85
b) Double welded butt, with full weld penetration and joints prepared as specified in Par. UW-51 (b) of Sec. VIII of the ASME Boiler & Pressure Vessel Code	0.90*
2) Electrical resistance weld and electric flash weld	0.85

**E* factor = 1.00 if this type joint is 100 percent radiographed.

Case No. 34

Inquiry: May austenitic steel pipe conforming to ASTM Specification A376, Types 304, 316 and 347, and to ASTM Specification A358, Types 304, 316, 321, 347 and 348, be used under Section 1 of the Code for Pressure Piping?

Reply: It is the opinion of the committee that austenitic steel pipe conforming to ASTM Specification A376, Types 304, 316 and 348, and to ASTM Specification No. A-358, Types 304, 316, 321, 347 and 348, may be used for conventional service under Section 1 of the Code for Pressure Piping with the allowable stress values shown in Table 1.

Case No. 35

Inquiry: Table 2A of the Code for Pressure Piping (ASA B31.1-1955), Section 1, lists pipe to ASTM Specification A-155, but does not specify flange or firebox quality. What was intended?

Reply: It is the opinion of the committee that firebox quality is intended, and that the allowable stress values and footnote listed should replace the values listed in the 1955 edition.

Case No. 36

Inquiry: In Par. 123 of ASA B31.1-1955 relative to short-time variations of pressure and temperature, how should these variations be treated?

Reply: It is the opinion of the committee that Par. 123 should read as follows:

"123. Variations in Pressure and Temperature.

"(a) Piping systems shall be considered safe for operation if the maximum sustained pressure and temperature on any part do not exceed the design pressure and temperature under this Code for all component parts of the system. It is recognized that variations in pressure and temperature inevitably occur and, therefore, the piping system shall be considered safe for occasional operation for short periods at higher than the design pressure and temperature.

"(b) Either pressure or temperature, or both, may exceed the design values if the stress in the pipe wall calculated by Formula 1, Par. 122, using the maximum expected pressure during the variation does not exceed the *S* value allowable for the maximum expected temperature during the variation by more than the following allowances for the periods of duration indicated:

"(1) Up to 15 percent increase above the *S* value during 10 percent of the operating period;

"(2) Up to 20 percent of the *S* value during 1 percent of the operating period."

Case No. 37

Inquiry: The June Mechanical Engineering on page 119 contains a

Stress values for Case No. 34

Material	ASTM Specification	Grade	Tensile strength, min	−20 to 100	Values of *S*, psi, for temperatures, F, not to exceed: 200	300	400	500	600	650	700	750	800	850	900	950	1000	1050	1100	1150	1200
Stainless Steel	A376	TP304	75000	18750	16650	15000	13650	12500	11600	11200	10800	10400	10000	9700	9400	9100	8800	8500	7500	5750	4500
		TP316	75000	18750	18750	17900	17500	17200	17100	17050	17000	16900	16750	16500	16000	15100	14000	12200	10400	8500	6800
		TP348	75000	18750	18750	17000	15800	15200	14900	14850	14800	14700	14550	14300	14100	13850	13500	13100	10300	7600	5000
	A358*	TP304	75000	17800	15800	14250	12950	11900	11000	10650	10250	9900	9500	9200	8950	8650	8350	8100	7100	5450	4300
		TP316	75000	17800	17800	17000	16600	16350	16250	16200	16150	16050	15900	15700	15200	14350	13300	11600	9900	8100	6450
		TP321 TP347 TP348	75000	17800	17800	16150	15000	14450	14450	14100	14050	13950	13800	13600	13400	13150	12800	12450	9800	7200	4750

*These stress values include a joint factor of 0.95 and apply to pipe in which the longitudinal weld is radiographed.

Table for Case No. 35

Material	ASTM Specification	Grade	Tensile strength, min	−20 to 650	Values of *S*, psi, for temperatures, F, not to exceed: 700	750	800	850	900	950	1000	1050	1100
Electric fusion welded: Carbon steel	A155*	C45	45000	10100	9800	8750	7500	5950					
		C50	50000	11250	10900	9900	8450	6550					
		C55	55000	12400	11900	10850	9200	7000					
Killed carbon steel		KC55	55000	12400	11900	10850	9200	7000					
		KC60	60000	13500	12900	11650	9700	7000					
		KC65	65000	14600	13950	12450	10250	7000					
		KC70	70000	15750	14950	13300	10800	7000					
Carbon molybdenum steel		CM65	65000	14600	14600	14600	14100	12950	11250				
		CM70	70000	15750	15750	15750	15200	13500	11500				
		CM75	75000	16900	16900	16900	16200	14300	11700				
½ Cr, ½ percent Mo steel		½ CR	65000	14600	14600	14600	14100	12950	11250	9000	5600		
1 percent Cr, ½ percent Mo steel		1 CR	60000	13500	13500	13500	13300	12800	11800	9900	6750	4500	2500
1¼ Cr, ½ Mo steel		1¼ CR	60000	13500	13500	13500	13500	12950	11800	9900	7000	4950	3600
2¼ percent Cr, 1 percent Mo steel		2¼ CR	60000	13500	13500	13500	13500	12950	11800	9900	7000	5200	3800

*The values tabulated apply to firebox quality material and to Class 2 pipe. For Class 1 pipe, which is heat treated and radiographed, these stresses may be increased by the ratio of 0.95 divided by 0.90.

proposed revision of Par. P-23(a) and (b) of Section I of the ASME Boiler and Pressure Vessel Code relative to *C* factor. Is similar action contemplated for Par. 122, Section 1 of ASA B31.1-1955?

Reply: It is the opinion of the committee that Par. 122, Section 1, ASA B31.1-1955 should be changed as follows:

Par. 122(a), change the definition of *C* to read:

"*C* = allowance for threading and minimum structural stability, in inches."

Par. 122(b), revise to read:

"(b) The values of *C* listed below do not include any allowance for corrosion and/or erosion, and additional thickness should be provided where they are expected. The allowance for threading and minimum structural stability are not intended to provide for extreme conditions of misapplied external loads or for mechanical abuse.

"The value of *C* in Formula 1 shall not be less than that given for the material in the following list:

Type of pipe	Value of *C*, in.
Cast iron pipe, centrifugally cast	0.14
Cast iron pipe, pit cast	0.18
Threaded steel, wrought iron or nonferrous	
¾ in. and smaller	0.065
1 in. and larger	Depth of thread
Grooved steel, wrought iron or nonferrous	Depth of groove plus 1/64
Plain end steel or wrought iron, up to and including 3½ in.	0.065
Plain end steel wrought iron 4 in. and larger	0.000
Plain end nonferrous	0.000

Case No. 38

Inquiry: May piping components made of nodular cast iron and to the dimensions of ASA Standards B.16.1, B.16b and B.16.5 be used in construction under the jurisdiction of Sections 1, 2, and 3 of the Code for Pressure Piping (ASA B31.1-1955)?

Reply: It is the opinion of the committee that, pending the completion of studies now in progress in Sectional Committee B16 and B31, nodular cast iron components made of material conforming to ASTM specification A395-56T may be used under the Sections indicated in the inquiry under the following conditions:

1) Components whose dimensions conform to ASA B16.1 and B16b may be used at the following maximum pressure-temperature ratings at temperatures between −20 F and 650 F:

Dimensions used	Maximum rating
Class 125 C.I. (B16,1)	80 percent of 150 lb carbon steel (B16.5)
Class 250 C.I. (B16b)	80 percent of 300 lb carbon steel (B16.5)
150 to 600 lb steel, inclusive	80 percent of carbon steel rating

These ratings are applicable to valves, providing that the valves in other respects merit these ratings. It is recognized that components made to the Class 125 and Class 250 standards or to API Standard 600 may be heavier than those made to the 150 lb and 300 lb standards, respectively. In the case of these heavier components, the additional wall thickness may be considered as additional correction allowance.

2) Until further experience is developed, the pressure at operating temperature shall not exceed 1000 psi.

3) Welding of the components is not employed in fabricating them in an assembled system.

4) They shall not be used in lethal service, as defined in each of the Sections indicated in the inquiry.

Case No. 39

Inquiry: May Type 304 stainless steel be used in nuclear energy installations handling liquid sodium and sodium-potassium mixtures under the rules of Section 1 of the Code for Pressure Piping (ASA B31.1-1955)?

Reply: It is the opinion of the committee that Type 304 stainless steel may be used in nuclear energy installations handling liquid sodium and sodium-potassium mixtures for construction under Section 1, provided the following conditions are observed:

1) The materials shall at least conform to one of the following specifications:

Pipe	ASTM A376
	ASTM A358-56T
Welding fittings	ASTM 403
Forgings	ASTM A182

The minimum carbon content of all material shall be 0.035 percent by check analysis.

2) If welding is employed, all completed welds shall be inspected as follows:

a) All longitudinal welds shall be fully radiographed.

b) All circumferential welds shall be fully radiographed wherever possible.

c) Where the size or configuration of the weld does not permit radiographing, it shall be examined by the fluid penetrant method.

3) The allowable stress values for seamless materials shall be as follows:

Temperature F	*S* value, psi
−20 to 100	18,750
200	16,650
300	15,000
400	13,650
500	12,500
600	11,600
650	11,200
700	10,800
750	10,400
800	10,000
850	9,700
900	9,400
950	9,100
1000	8,800
1050	8,500
1100	7,500
1150	5,750
1200	4,500
1250	3,250
1300	2,450
1350	1,800
1400	1,400
1450	1,000
1500	750

4) A joint factor of 0.95 shall be applied to longitudinal welds which have been fully radiographed.

Case No. 40

Inquiry: Section 1 of the Code for Pressure Piping (ASA B31.1-1955) does not mention reinforced concrete pipe. May such piping be used under Section 1?

Reply: It is the opinion of the committee that, although the Code does not contain rules for the design of reinforced concrete pipe, pipe complying with the following specifications may be used for service water and condensing water systems at 43 psi and below at the ratings assigned in the specifications:

AWWA C-300—Reinforced Concrete Water Pipe—Steel Cylinder Type—Not Prestressed

AWWA C-301—Reinforced Concrete Water Pipe—Steel Cylinder Type—Prestressed

AWWA C-302—Reinforced Concrete Water Pipe—Noncylinder Type—Not Prestressed

Federal Specification SS-P-381 Pipe — Pressure, Reinforced Concrete, Pretensioned Reinforcement (Steel Cylinder Type). ‡

tricks and trends

LESTER T. AVERY, author of this feature, is president of Avery Engineering Co., Cleveland mechanical contractor, and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors. On this page, which appears regularly, he reflects on his installation experiences.

What Price Speed?

"A REFRIGERATING compressor depreciates with every revolution."

This statement was made to me by the chief engineer of a firm of architects and engineers back in 1928. At that time we were trying to get him to approve a compressor speed of 125 rpm on a horizontal carbon dioxide compressor when his specifications called for 90 rpm. What a fast road we've traveled since then!

Prior to the advent of fluorinated hydrocarbon refrigerant compressors, ammonia and CO_2 compressors were limited in piston speed and reciprocating speed, due chiefly to lubrication and valve operation problems. The advent of the ammonia vertical single acting unit permitted speeds in the general range of 300 to 400 rpm. That was considered fast.

Horizontal compressors of the ammonia or CO_2 type ran at speeds from 90 to 150 rpm. Then, vertical double-acting CO_2 units were developed for direct connection to synchronous motors and a speed of 377 rpm was considered about tops.

Compressor weights were high at these low speeds. Just as a rough figure, the weight of a 10 ton CO_2 horizontal compressor with motor, flywheel, and condenser was around 5000 lb, or 500 lb per ton of cooling capacity. Vertical ammonia machines ran somewhat less, but were in the range of 300 to 400 lb per ton.

With the development of the fluorinated hydrocarbon refrigerant compressor in the early 1930's—with its low pressures and fast acting valves—speeds were increased until now we have many simple direct-connected compressors operating at 1750 rpm and other type units going up into 4000 to 5000 rpm. Lubrication improvements have been made accordingly.

It is interesting to note that today's 10 ton refrigerant No. 12 compressor, complete with hermetic motor and water cooled condenser, weighs only about 500 lb. This is just 50 lb per ton, or one-tenth the weight of the 1932 compressors.

Of further interest is that the cost per ton of cooling capacity is about the same, strange as that may seem. In other words, we could buy a 10 ton compressor in the 1930's for about $1000, or 20c per lb. Now the same capacity unit costs about the same, but is $2.00 per lb of weight. This shows the difference in the cost per pound of the refrigeration system or refrigeration compressor or its components, due to what is called "controlled inflation."

Let's get back to the chief engineer's remark. There may be something to what he said. Certainly it's true that the slow speed compressors plugged along year after year, day after day without showing any signs of getting tired. Bearings wore loose, valves required replacing or grinding or new springs, piston rings had to be replaced from time to time, and sometimes cylinders had to be rebored. But, in general, this compressor was capable of being serviced and maintained and kept in running condition year after year.

To illustrate this, in Cleveland there are a few installations left of the horizontal CO_2 compressor type that were installed before 1920. A hotel installation, for example, was installed in 1916 and its compressors are still giving useful service after 43 years.

True, they're big and cumbersome and eventually will be replaced with more modern high speed equipment. But until they are replaced, they have done useful work and have been kept in repair at reasonable cost.

On the other hand, the high speed compressor has given trouble from time to time due to failure of lubrication, particularly on the refrigeration slugging problem whereby wet liquor coming back interfered with lubrication and caused excessive wear.

Sometimes refrigerant coming back would damage the machine to what we called "scrambling," whereby pistons, valves, and other components were damaged beyond repair and the entire compressor had to be replaced.

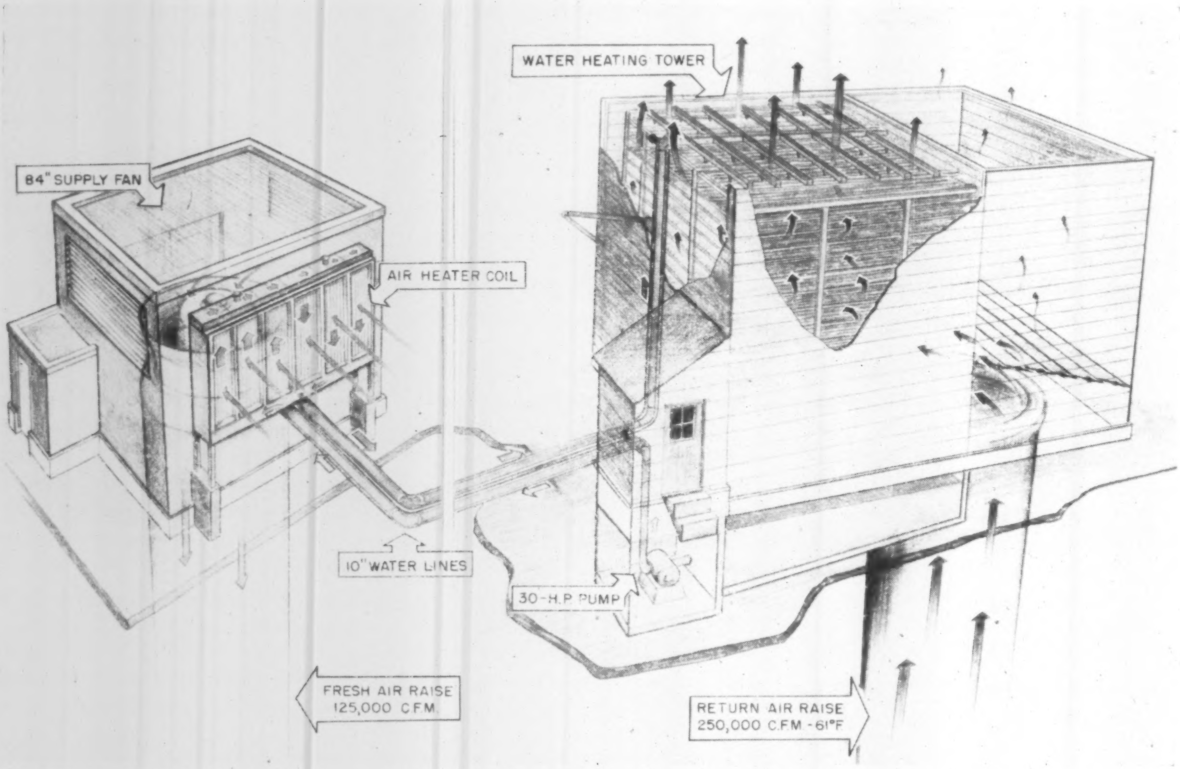
Just last summer we had to replace a 20 ton compressor which "scrambled." It's not too uncommon in the high speed machines to have automatic control failures causing high speed wear and damage. The replacement exchange price was over $2000. That's just the bare compressor without the condenser or the motor or the drive.

That's the price you pay for speed. Certainly no one wants to put in heavy, cumbersome, low speed compressors when you can buy the neat, fast, high speed ones. In fact, nobody makes the low speed machines anymore except for special ammonia duty, where there are still customers who prefer the open type horizontal reciprocating compressors.

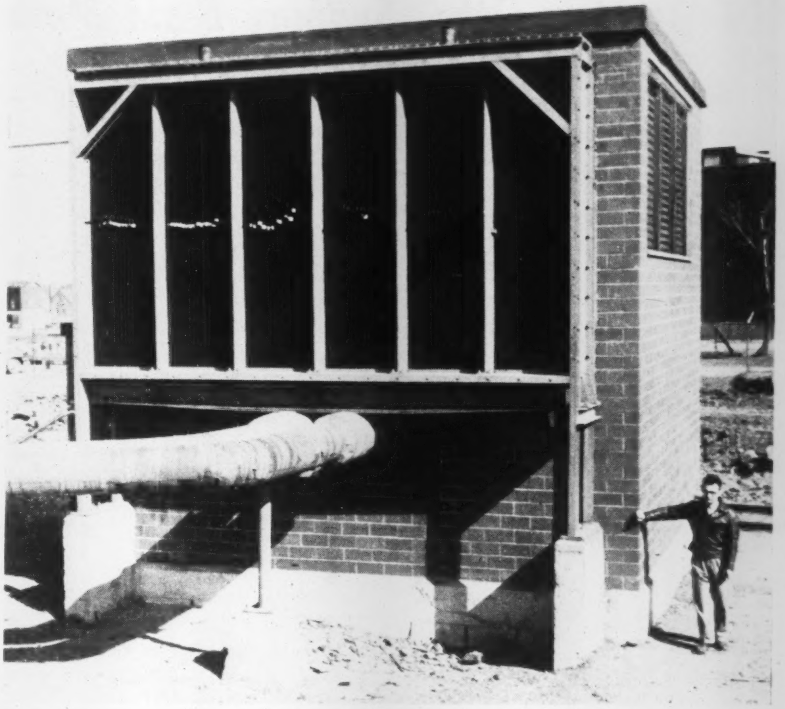
So much for the trend toward higher speed, lighter weight, smaller floor space, and more automatic operation. The trick is to keep all the components in balance. What speeds, weights, and costs per ton of cooling and per pound of weight will the next decade bring? ≠

Heat Outdoor Air For Nickel Mine By Recovery Heat Exchange System

Air exhausted from mine is passed over large coil through which water is circulated. Heated water then goes through another coil which heats incoming outdoor air. System has proved to be successful in underground mining, and also has possibilities for use in other underground areas.


WATER HEATING TOWER
84" SUPPLY FAN
AIR HEATER COIL
10" WATER LINES
30-H.P. PUMP
FRESH AIR RAISE 125,000 C.F.M.
RETURN AIR RAISE 250,000 C.F.M. -61°F

CUTAWAY SKETCH shows Creighton mine's unique heat exchange system. On left is fan house with air heater coil installed in opening in west wall. Over it is superimposed an impression of circular concrete outdoor air shaft through which heated outdoor air is pumped underground. Return air raise, or shaft as referred to in text, from underground leads into water heating tower at right, in which are installed fill racks through which water filters while being heated



AIR HEATER COIL, consisting of 840 vertical tubes, is installed in opening in one wall of fan house. Openings in two other walls of fan house allow unheated outdoor air to reach fan during warmer eight months of year

BY JAS. G. RUTHERFORD
International Nickel Co.
of Canada, Ltd.

A UNIQUE heat exchange system, installed at the junction of two adjacent airways, is used to heat outdoor air supplied to the upper mining levels of the Creighton mine in the Sudbury Basin in northern Ontario, Canada.

The required heat is obtained by cooling the return air exhausted to the surface from a deeper section of the mine.

The proximity of the air intake to the junction of the return air shaft suggested the possibility of installing a heat exchanger between the two airways. More than 1½ times the 7.2 million Btu per hr required to heat the outdoor air from −20 to 30 F is obtained when the return air is cooled from 61 F to 40 F.

The temperature at the surface during the four winter months, December to March, averages 15 F, and the minimum temperature is about −30 F.

There are two separate underground mining operations at Creighton. Between the surface and the 1500 ft level, a large tonnage of disseminated ore overlying the original workings is mined by panel caving. On the lower levels, the higher grade ores are mined entirely by the square-set method. This is the mine's deepest operation, with the lowest level 5425 ft below surface.

Ventilate Each Area Separately

A separate ventilation system has been installed for each mining area:

The lower, or square-set, mining area is ventilated by a push-pull system. Both the intake and exhaust fans are located underground, but above the mining zone.

Outdoor air is drawn from the surface through the open pit and the footwall workings into the main intake airway, 600 ft below the surface. Most of the outdoor air is supplied from the intake to the lower production levels, and the air then moves upward through the stoping blocks.

Exhaust air is drawn into the return system near the top of the mining areas. The underground exhaust fan delivers 250,000 cfm to the main return air shaft, 17 ft in diameter, which rises to the surface. Air reaches the surface at 61 F saturated.

The slusher drifts in the upper, or caving, mining area are ventilated primarily by an exhaust system. This vertical exhaust fan handles 300,000 cfm.

An outdoor air system, with a surface fan and a passageway 120 sq ft in cross-section, supplies more than half of the air directly to the mine via the service connections. The balance is drawn down from surface through the caved ore and the box holes by the exhaust fan.

The intake fan is an 84 in. diameter axial flow fan mounted vertically on the concrete collar of the air shaft. The fan impeller, which has adjustable pitch blades, is mounted on the downward shaft extension of the 150 hp, 720 rpm vertical motor.

How Other Sudbury Basin Mines Are Heated

Various types of systems are used to heat International Nickel's five mines in the Sudbury district. Aside from the Creighton installation, these are:

1) At two of the mines, steam blast coils are used in the discharge duct of the intake fan. The larger installation consists of seven 30 × 60 in. single-row coils. Steam is supplied at 35 psi, and the coils are rated to heat 110,000 cfm of −20 F outdoor air to 30 F. The volume of air supplied to the coils and through a bypass above the coils is controlled thermostatically using motor operated dampers. The fan speed is reduced during sub-zero periods.

2) A direct transfer, oil fired air heater, rated at 7 million Btu per hr is used at one mine. The burner modulates from one-quarter to full fire and cuts on and off automatically, depending on the outside temperature. Fan volume is kept constant over the heating period, at 125,000 cfm.

3) At one intake, where it is necessary to supply 500,000 cfm during the winter to maintain a positive delivery in ore excavating areas partially mined through to the surface, the outdoor air is heated in two large shafts which form part of the intake system. Water is sprayed at the top of the shafts so as to form ice in the cold air. The latent heat of freezing is the main source of heat transferred to the air. During sub-zero periods the maximum volume of water sprayed exceeds 500 gpm, and the total heat supplied to the outdoor air is 25 million Btu per hr.

The fan will handle a maximum of 200,000 cfm at 4 in. WG; during the winter its performance is reduced to supply 125,000 cfm at 2.5 in. WG.

Water Heated, Cooled in Coils

The heat exchanger consists of two units, one at each air shaft. Water is heated by direct contact with the return air in a tower adjoining the stack on the shaft. At the outdoor air shaft the air is heated as it is drawn through a large water coil that occupies one wall of a building constructed over the intake fan.

Water is circulated between the two units through 10 in. insulated pipelines by a 30 hp pump handling 1400 gpm. The pump draws warmed water from a sump below the tower and supplies it to the coil; the water circulates through the finned tubes of the coil at high velocity and the cooled water is returned to the top of the tower.

Except for this resistance of the two units to air flow, which is equivalent to 40 hp, the power to the pump is the only energy required to operate the heat exchange system.

Tower Sump Holds 19,000 Gal

A concrete sump, constructed partially below ground level beside the concrete collar of the return air shaft, is the foundation for the water heating tower adjoining the exhaust stack over the shaft. The sump has a capacity of 19,000 gal of water. The tower is 25 ft square and 24 ft high.

The return air is directed into the lower section of the tower, through an opening 8 ft high and 24 ft wide, by closing stainless steel dampers in the exhaust stack on the return air shaft. The air rises through the tower and discharges out the top through spray eliminators.

The resistance of the tower to air flow is overcome by the underground exhaust fan. The tower was designed for an original volume of 200,000 cfm.

With the present volume of 250,000 cfm, the dampers are not closed tightly during the winter and approximately 25,000 cfm exhausts directly through the stack.

Cold return water from the air heater coil is delivered to the top of the tower through a 10 in. insulated pipe and distributed over the tower area through a system of rectangular wooden troughs.

The temperature of the water is increased up to 9.5 F deg as it passes through the tower, and the return air is cooled a maximum of 11 F deg.

In cooling the saturated air, over 7 gpm of water vapor is condensed. To prevent a buildup in the acidity of the water, 21 gpm of water is drained off the return pipe through a 4 in. drain line, and the difference is made up with fresh water supplied to the sump, controlled by a float valve.

The circulating pump is located in a concrete well at the low end of the sump and is operated with flooded suction.

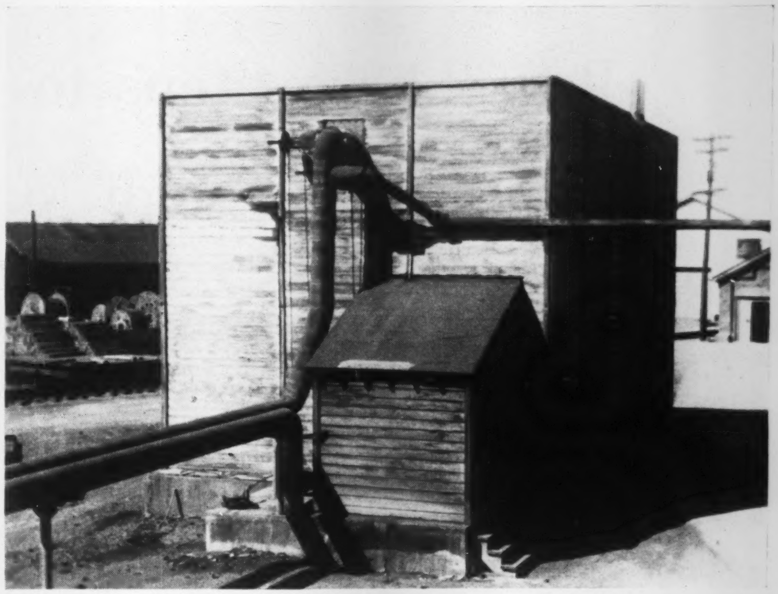
Reduce Outdoor Air Volume

The outdoor air heating coil is located against one wall of a brick tile building that houses the vertical fan on the intake to the caving area. The building is 20 × 18 ft and 20 ft high, with a flat concrete floor slab. An electrical control room, 6 × 9 ft and 10 ft high, adjoins the fan house.

There is a large opening in each of three walls of the building. Two of the openings, in opposite walls, allow unheated outdoor air to reach the fan during the warmer eight months of the year, the flow being controlled by manually operated louvers. The third opening is the entry for outdoor air passing through the heater. In winter, the fan volume is reduced from 200,000 to 125,000 cfm, and all the air is drawn through the heater.

The air heater is 17 ft. 3 in. wide and 12 ft high, and is supported 7 ft above ground level against the out-

WATER HEATING TOWER houses 19,000 gal capacity water sump. Temperature of water is increased up to 9.5 F deg as it passes through tower, and return air is cooled a maximum of 11 F deg



side of the wall at the openings. The heater consists of 840 vertical tubes, 5/8 in. OD and 10 ft, 2 in. long, set in eight rows in a heavy steel frame which is constructed in six sections with 140 tubes per section.

The warmed water is pumped to the supply side of the bottom header, up through the 420 tubes (eight rows) in the three sections on that side of the coil, across the top header, and down through the 420 tubes in the other three sections to the return side of the bottom header. The cooled water discharges through the return pipeline to the top of the water heating tower.

The velocity in the tubes is 5 fps. Thus, the water makes one pass through the tubes in 2 sec, giving a total time of 4 sec in the air heater tubes per circuit. The air resistance across the heater, 0.8 in. WG, is overcome by the intake fan.

Guard Against Freeze-up

To prevent freezing in the coil tubes in the event of pump failure, the intake fan and the pump motors are wired so that the power to the fan is cut off when the pump stops.

Both the supply and return pipelines are sloped downward toward the pump so that the water can drain quickly from the coil through the pump to the sump, and there is a bypass with check valve from the discharge line to the supply line to drain the return side of the system. Two vacuum breaker valves above the top header permit quick drainage from the coil when the pump stops. ‡

UN Reports on New Energy Sources

TWO RECENT United Nations' survey reports concern the problems of energy development from both existing and new sources. The reports were prepared by the UN Secretariat at the request of the Economic and Social Council and were considered by the Council at its last session in Mexico City, which opened April 7.

Progress of the last two years in developing applications of solar, wind, and geothermic energy is reported in the study.

In a summary of recent developments, the report says that direct conversion of solar energy to electricity by means of solar batteries and by thermo-electric converters is rapidly being advanced. Work also continues, though at a lesser rate, on use of solar energy in steam generation, air conditioning, refrigeration, and water distillation.

In the field of wind power, the past two years has been a period of "consolidation and of transition from experimentation to applied research and commercial use." In underdeveloped countries, wind power surveys have led to the installation of the first modern wind power plants.

In regard to geothermic power (natural steam and hot water), the report notes that production of electricity from this source—limited two years ago to activity in Italy—is being started in other countries. The greater interest in this source of power is also reflected in the search for new geothermic fields.

The second report, a comprehensive review of energy development problems, points out that the importance of energy as a basic factor in economic development has received increasingly wide recognition.

The survey contains chapters on general energy problems, conventional fuels, nonconventional energy, and other technical problems. Three annexes describe the relevant UN services, those of specialized agencies and of other international organizations active in the energy field. ‡

Follow These Steps to Build Profits Through Maintenance

MAINTENANCE builds profits, said Arthur F. DeLong, plant engineer, Exide Industrial Div., Electric Storage Battery Co., Philadelphia, speaking at the recent Plant Maintenance & Engineering Conference in Cleveland. Fifty dollars saved through maintenance may be worth $1000 in orders, he said.

To realize these savings, the broad approach must be taken. The first step, in an existing or a prospective plant, is to prepare single line drawings of the points of utilization for each of the services distributed in the plant. These would locate each piece of consuming equipment. In the existing plant, existing pipelines and duct systems, including their sizes, will be shown. Operating department boundaries should be included on the preliminary layouts.

Location of process exhaust hoods and volumes of air exhausted should be carefully spotted on the heating plan. This will permit makeup air units to be properly located to prevent drafty conditions.

At each point of use for items such as hot and cold water and steam, the state of the material supplied after completion of the process should be noted.

For example, is the water contaminated? If so, with what? What effect will there be on waste piping? Are the wastes valuable? Or must they be neutralized?

Remember, the first step in planning a waste disposal system is to reduce the volume of the wastes to be treated by preventing dilution, he said.

Is the water warmed? If so, how much? How much warming can be tolerated? Can warmed water of ample supply be used for further cooling needs, or in process? Can heat be reclaimed for preheating process water? Even if contaminated with chemicals or solids, plate-coil heat exchangers can reclaim much heat with minimum maintenance cost.

Cooling water can be run through air compressor aftercoolers, then to continuous blowdown heat exchangers. The warmed water then goes through air compressor jackets. The warmed water can be used this way in greater volume, which reduces condensation. The water outlet temperature is maintained at about 130 F at his plant. It is then used as boiler feedwater, and extra storage capacity built into feedwater heaters absorbs surges without waste. Surplus is bypassed ahead of the heater.

Does the water go into the product or is it used for spray cooling? Do wastes go into leaching ponds? Is water lost by evaporation from hot processes?

If water is required, which points require potable water and which do not? Can you dam a stream or drill a well and obtain water at low cost? And by using recharge wells with uncontaminated water, large volumes can be withdrawn without depleting supply.

When considering needs for heating and cooling, look closely for processes that require cooling, and others that require heating nearby, he advised. Would a warm rinse help? For example, he found a cooling tower being used to cool mold cooling water, while on the floor below, steam was being used to heat fresh water in a rinse tank.

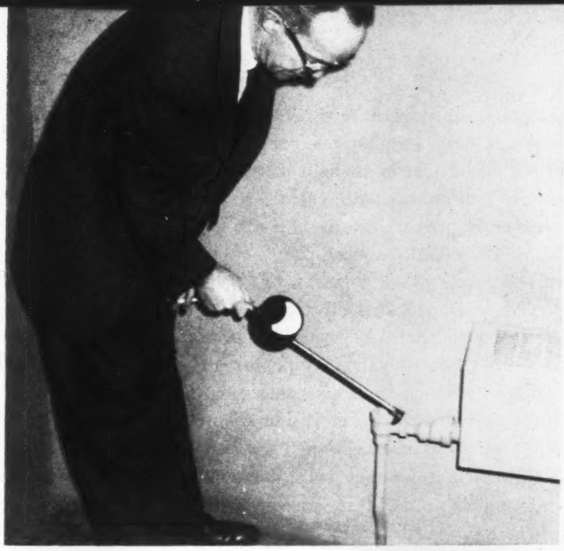
When figuring water needs, consider every way to avoid excessive use: recirculating water in a tank to obtain increased turbulence; installation of orifices in unions to prevent oversupply; introduction of water to the bottoms of tanks to prevent short-circuiting; solenoid valves tied in to the process to shut off water when not in use. In a cooling installation, recycling permits use of water to be confined to that needed for makeup. You will have to treat your makeup to avoid scaling and maintain proper pH and cleanliness, but with limited makeup, the cost for this is not prohibitive.

Use of multiple cascaded rinse water tanks is an extremely valuable and effective way to reduce consumption of water, and with it, the cost of waste treatment. Reclaiming of chemicals or waste products can be rendered much less costly and more effective by enabling the volume to be greatly reduced and concentration increased.

Now that the uses of the various services have been analyzed, and the processes checked for possible re-use or conservation measures, we have made several gains, he said. We have removed most of the waste. We have developed standards of use quantities which can be used for control purposes. And by knowing the amounts of use and their location, we can intelligently plan for the installation of meters which will permit policing of the budgeted amounts, he stated.

Remember, nothing is as ineffective, insofar as control is concerned, as a charge which cannot be substantiated, and in which improvement cannot be measured, he continued. How many firms make monthly charges to departments by allocation of total usage by percentage of total used? Although a good rule of thumb is to use a meter when the annual usage in the area is 10 times the installed cost of the meter, where heavy use over standard consumption is possible, a lesser figure is justified.

Some other methods his plant has used to decrease utilities expenditures for steam and heat are:



STEAM SPECIALTY ITEMS should always be accessible for testing, servicing. Here, L. E. Smith, superintendent of maintenance for Exide Industrial Div., checks trap operation using portable pyrometer

LOCATIONS of process exhaust hoods should be spotted on building heating plans. Damper in duct, being manipulated by Mr. Smith, closes off exhaust when process is shut down, thus saving needless waste of heated air

1) Keep steam pressure down to the minimum required. Radiation losses are reduced, expansion stresses less, and leakage losses lowered. Through closer control, his plant was able to reduce operating pressure from 175 to 105 psi.

2) Insulate roofs, walls, and pipes (1 ft of 2½ in. pipe uninsulated wastes $2.50 worth of steam per day — much over the cost of insulation). And don't forget flanges, valves, and fittings; their exposed area is the equivalent of far more than their actual length.

3) Shut off steam to dead pipes to save radiation.

4) Keep heating surfaces clean and unimpeded, including filters.

5) Trap coils individually and return the condensate.

6) Flash high pressure condensate into low pressure mains through flash tanks, saving the excess heat loss back to the boiler room.

7) Consider electric heat for small uses in remote locations; use high temperature oils to obtain the even heating characteristic of steam. (We found ourselves using several hundred pounds per hour to keep lines hot to supply steam to a remote location requiring about 30 lb per hr, he related.)

8) Provide test tees on traps to permit testing.

9) Provide boiler water treatment to prevent foaming and carryover.

10) Develop heating standards from actual test: pressure, the number of heaters required at varying outdoor conditions, and the hours of operation needed under these conditions.

11) Use thermostatic control of heaters and timers to give night and weekend setback. Proper thermostat settings are important.

12) Conduct a campaign to keep doors and windows closed. Use electric eye openers with time-delay closing. Repair leaky sash. Replace broken doors and windows.

13) Reduce heat in unused areas.

14) Use inlet ducts to heaters from floor level, and use downblow heaters in high ceiling areas to reclaim ceiling heat.

15) Have proper, unimpeded, and overlapping flow pattern from heaters. Provide for re-use of heated or cooled air.

16) Make use of zoning and shutoff for reduction of heat to areas occupied only part of the time.

17) Provide local supplementary heat in remote areas or rooms occupied during setback periods.

18) Conduct periodic maintenance checks of traps, vacuum leaks, and reducing valves.

19) Keep ventilation exhaust set to minimum requirements, and turn off ventilation when not required.

Cut Compressed Air Costs

Compressed air costs have been reduced by:

1) Using two-stage compressors, cutting off single-stage units first as load decreases, and low pressure units where high pressure is not needed.

2) Reducing pressure in the system to the minimum and reducing pressure on weekends. Leaks increase as the square root of the pressure.

3) Moving receivers and compressor suction inlets to cooler locations.

4) Keeping inlet filters clean.

5) Using ample pipe sizes to avoid pressure loss.

6) Using separators and moisture traps.

7) Checking leaks by timing compressor *on* cycle during plant shutdown periods.

How to Save on Fuel

To save gas and other fuels, he said:

1) Use gas savers on torches.

2) Make combustion efficiency tests on furnaces.

3) Replace on-off controls with modulating controls.

4) Replace open burners with fully enclosed burners.

5) Preheat combustion air with heat from flue gas.

By applying these principles of conservation to all utilities, excess use can be eliminated. With proper metering, an incentive to conserve is provided, and by analyzing needs, an economical, flexible distribution system can be laid out, with due attention to looping, future loads, and pressure drop. If drawings are kept up to date, additional branches can be added in a logical manner, and the effect on metering planned.

Remember, low or high utility maintenance costs are built into a system when it is designed and erected. Errors at this stage can plague you for years into the future. Cost cutting in an initial installation can prove quite costly in the long run.

Provide isolation valves so that servicing can be done, or branches added at a later date without shutting down whole areas. One shutdown will equal the cost of many valves.

Provision of sufficient instrumentation pays off. Pressure gages located at intervals along mains help solve many problems. Recording flow, current, pressure, and temperature meters save time and disclose unexpected facts when problems arise, but provision must be made in advance for installation when needed.

Causes of High Piping Maintenance Costs

Some of the items to which excessive piping maintenance costs can be traced, and which can often be designed or built out of the system, are:

1) Interior corrosion from oxygen, CO_2, or the material carried. For example, if valves won't hold, check them to see if condensate can accumulate and cause oxygen corrosion.

2) Corrosion from exterior sources, — sweating, atmosphere, electric currents, corrosive materials in which pipe is buried.

3) Erosion from high velocities, entrained solids, or droplets.

4) Creep, due to high stresses in bolts, or insufficient support.

5) Initial misalignment stresses.

6) Temperature-induced stresses, bending, misalignment, transfer of loads due to expansion of risers, or unlubricated expansion joints.

7) Insufficient supporting or improperly designed supports, and loose or binding supports.

8) Excessive pressure or temperature.

9) Sags, water hammer, vibration, and shock. Considerable trouble can be expected if pipe supports are not examined from time to time, loose supports tightened up, and sags which produce liquid pockets removed.

10) Improper selection of valves or fittings.

11) Leaks not promptly repaired or detected.

12) Dirt, gloves, banana peels, welding icicles, carryover, scale in pipes.

13) Improper trade procedures during installation.

Correction of the improper installation requires proper training and supervision. Many mechanics, particularly in small plants, have received their ratings through seniority, and have never taken a formalized training program that emphasizes proper tools and techniques. Films and booklets to help solve this problem are available free of charge from various sources.

Some improper installations are suggested in the list of items just given — insufficient support, pitch, selection of valves. Some other common malpractices include: valves placed with pressure on wrong side of discs; valves in vertical lines that carry settling sludges; wrenches applied to wrong side of valves; pipe threads entering valves or fittings too long; improper placement of dope; bolting up misaligned pipe; gasket inside diameters projecting into pipe; packing overtightened instead of replaced.

Future maintenance must be considered when an installation is made, so if valves are installed stem down, or where not readily accessible for operation, and if insulation is installed at flanges or valves so that it cannot be readily removed for maintenance and bolt tightening or inspection, trouble can be anticipated.

If test tees, unions, dirt legs, strainers, ample drip pockets and traps are not provided in the design, because of cost cutting, then insufficient specifications, neglect, or high costs are bound to follow.

Consider servicing needs. Are traps or reducing valves accessible for testing and servicing? A common cost-cutting practice employed today is the construction of traps with nipples to a standard overall length and with half-unions installed, so that traps can be replaced in an instant, he said. Other cost cutting methods include the use of angle valves, union valves, and fittings to reduce the number of fittings and, as a result, sources of leaks.

The cost of small leaks can grow to astronomical proportions. One drop of water each two seconds will fill twelve 55 gal drums in a year. A 1/32 in. diameter pin hole in a 60 lb water line will waste 7500 gal. If hot water, the volume wasted may be three to four times more valuable. A 1/16 in. diam leak at a joint in a 100 psi air line will lose 6 cfm, at a cost of $175 per year. A group of these spotted throughout the plant can keep an extra compressor in operation.

His plant recently inspected oxygen distribution lines with leak detector fluid squirted at every fitting. Almost one-third of the total number of joints were leaking minute to moderate amounts of this expensive commodity.

Steam leaks are also exorbitant. Moderate or high pressure steam leaks may evaporate immediately and be undetectable in noisy areas. He said he had seen valve interiors cut an inch deep from a long standing leak, and flanges and expansion joints grooved to almost the full depth of the metal from neglected leakage in out-of-the-way places. A 1/16 in. diam steam leak may cost $100 per year, but the excessive humidity and temperature resulting may promote corrosion and deterioration of electrical installations in surrounding areas of even greater consequence.

The return on the investment in repairing leaks, it can be seen, may be much more profitable than putting the same amount of labor in product manufacture, he concluded. ⌗

Directory of Addresses for Engineering Societies, Associations

Acoustical Society of America, 335 E. 45th St., New York 17, N. Y.
Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N.W., Washington 6, D. C.
Air-Conditioning and Refrigeration Wholesalers, 1500 W. Third Ave., Columbus 12, O.
Air Cooling Institute, P.O. Box 2121, Wichita Falls, Tex.
Air Distribution Institute, 2130 Keith Bldg., Cleveland 15, O.
Air Filter Institute, Box 9325, Washington 5, D. C.
Air Moving and Conditioning Association, Inc., 2159 Guardian Bldg., Detroit 26, Mich.
Air Pollution Control Association, 4400 Fifth Ave., Pittsburgh 13, Pa.
Air Pollution Foundation, 2556 Mission St., San Marino, Calif.
Aluminum Association, 420 Lexington Ave., New York 17, N. Y.
American Concrete Institute, 22400 W. Seven Mile Rd., P.O. Box 4754, Redford Sta., Detroit 19, Mich.
American Foundrymen's Society, Golf and Wolf Rds., Des Plaines, Ill.
American Gas Association, 420 Lexington Ave., New York 17, N. Y.
American Industrial Hygiene Association, 14125 Prevost, Detroit 27, Mich.
American Institute of Architects, 1735 New York Ave., N.W., Washington 6, D. C.
American Institute of Electrical Engineers, 33 W. 39th St., New York 18, N. Y.
American Institute of Plant Engineers, P.O. Box 185, Barrington, Ill.
American Institute of Supply Associations, Inc., 402 Albee Bldg., Washington, D. C.
American Meteorological Society, 3 Joy St., Boston 8, Mass.
American Nuclear Society, 86 E. Randolph St., Chicago 1, Ill.
American Society of Agricultural Engineers, 420 Main St., St. Joseph, Mich.
American Society for Engineering Education, University of Illinois, Urbana, Ill.
American Society of Heating Refrigerating and Air-Conditioning Engineers, Inc., 62 Worth St., New York 13, N. Y., and 234 Fifth Ave., New York 1, N. Y.
American Society of Heating Refrigerating and Air-Conditioning Engineers Research Laboratory, 7218 Euclid Ave., Cleveland 3, O.
American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.
American Society of Safety Engineers, 5 N. Wabash Ave., Chicago 2, Ill.
American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.
American Standards Association, 70 E. 45th St., New York, N. Y.
American Welding Society, Inc., 33 W. 39th St., New York 18, N. Y.
Anthracite Institute, 237 Old River Rd., Wilkes-Barre, Pa.
Association for Applied Solar Energy, Suite 222, Central Plaza Bldg., 3424 N. Central Ave., Phoenix, Ariz.
Atomic Industrial Forum, Inc., 3 E. 54th St., New York 22, N. Y.
Better Heating-Cooling Council, 250 Park Ave., New York 17, N. Y.
Bituminous Coal Institute, Southern Bldg., 15th and H Sts., Washington 5, D. C.
Bituminous Coal Research, Inc., 121 Meyran Ave. at Forbes St., Pittsburgh 13, Pa.
Building Research Advisory Board, and Building Research Institute, National Academy of Sciences-National Research Council, 2101 Constitution Ave., N.W., Washington 25, D. C.
Code for Pressure Piping, ASA Sectional Committee B31, Room 647, 420 Lexington Ave., New York 17, N. Y.
Committee on Steel Pipe Research, American Iron and Steel Institute, 150 E. 42nd St., New York 17, N. Y.
Compressed Air & Gas Institute, 122 E. 42nd St., New York 17, N. Y.
Construction Specifications Institute, 1914 Connecticut Ave., N.W., Washington 9, D. C.
Consulting Engineers Council, 326 Reisch Bldg., Springfield, Ill.
Cooling Tower Institute, 420 Emerson St., Palo Alto, Calif.
Copper and Brass Research Association, 420 Lexington Ave., New York 17, N. Y.
Diamond Core Drill Manufacturers Association, 122 E. 42nd St., New York 17, N. Y.
Edison Electric Institute, 750 Third Ave., New York 17, N. Y.
Electrical Institute of Washington, Pepco Bldg., 10th and E Sts., N.W., Washington 4, D. C.
Environmental Equipment Institute, 9 Spring St., Princeton, N. J.
Expansion Joint Manufacturers Association, 53 Park Place, New York 7, N. Y.
Fire Equipment Manufacturers Association, Suite 759, One Gateway Center, Pittsburgh 22, Pa.
Fluid Controls Institute, Inc., 320 Broadway, New York 7, N. Y.
Formed Steel Tube Institute, 850 Hanna Bldg., Cleveland 15, O.
Fuel Oil & Water Heater Manufacturer's Association, P.O. Box 151, East Greenwich, R. I.
Gas Appliance Manufacturer's Association, 60 E. 42nd St., New York 17, N. Y.

(Continued on next page)

Heat Exchange Institute, 122 E. 42nd St., New York 17, N. Y.
Humidifier Association, 20211 Harvard Ave., Cleveland 22, O.
Hydraulic Institute, 122 E. 42nd St., New York 17, N. Y.
Industrial Heating Equipment Association, Inc., Associations Bldg., Washington 6, D. C.
Institute of Boiler and Radiator Manufacturers, Room 408, 608 Fifth Ave., New York 20, N. Y.
Institute of Environmental Engineers, 9 Spring St., Princeton, N. J.
Institute of Heating & Air Conditioning Industries, Inc., 1254 W. Manchester Ave., Suite No. 3, Los Angeles 44, Calif.
Institution of Heating and Ventilating Engineers, 49 Cadogan Sq., London, S. W. 1, England.
Instrument Society of America, Granite Bldg., 313 Sixth Ave., Pittsburgh 22, Pa.
Insulation Board Institute, 111 W. Washington St., Chicago 2, Ill.
Insulation Distributor-Contractors National Association, Inc., 1632 K St., N.W., Washington 6, D. C.
Liquefied Petroleum Gas Association, 11 S. LaSalle St., Chicago 3, Ill.
Manufacturers' Standardization Society of the Valve & Fittings Industry, 420 Lexington Ave., New York 17, N. Y.
Mechanical Contractors Association of America (formerly Heating, Piping & Air Conditioning Contractors National Association), Suite 570, 45 Rockefeller Plaza, New York 20, N. Y.
Modular Building Standards Association, 2029 K St., N. W., Washington 6, D. C.
National Association of Building Owners and Managers, 134 S. LaSalle St., Chicago 3, Ill.
National Association of Corrosion Engineers, 1061 M & M Bldg., Houston 2, Tex.
National Association of Pipe Nipple Manufacturers, Inc., 501 Fifth Ave., New York 17, N. Y.
National Association of Power Engineers, Inc., 176 W. Adams St., Chicago, Ill.
National Association of Practical Refrigerating Engineers, 435 N. Waller Ave., Chicago 44, Ill.
National Board of Fire Underwriters, 85 John St., New York 38, N. Y.
National Bureau of Standards, Building Technology Div., Air Conditioning, Heating & Refrigeration Section, Washington 25, D. C.
National Certified Pipe Welding Bureau, Suite 570, 45 Rockefeller Plaza, New York 20, N. Y.
National Coal Association, Southern Bldg., Washington 5, D. C.
National District Heating Association, 827 N. Euclid Ave., Pittsburgh 6, Pa.
National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N. Y.
National Fire Protection Association, 60 Batterymarch St., Boston 10, Mass.
National Heating & Airconditioning Wholesalers, Inc., 1200 W. Fifth Ave., Columbus 12, O.
National Heating & Cooling Sales Association, Inc., 50 Commerce St., Newark 2, N. J.
National Insulation Manufacturers Association, 441 Lexington Ave., New York 17, N. Y.
National Mineral Wool Association, 2906 Americas Bldg., Rockefeller Center, New York 20, N. Y.
National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.
National Society of Professional Engineers, 2029 K St., N.W., Washington 6, D. C.
National Swimming Pool Institute, Harvard State Bank Bldg., Harvard, Ill.
National Warm Air Heating and Air Conditioning Association, 640 Engineers Bldg., Cleveland 14, O.
Oil-Heat Institute of America, Inc., 500 Fifth Ave., New York 36, N. Y.
Pipe Fabrication Institute, Room 759, One Gateway Center, Pittsburgh 22, Pa.
Plumbing-Heating-Cooling Information Bureau, 35 E. Wacker Dr., Chicago 1, Ill.
Producers' Council, Inc., 2029 K St., N.W., Washington 6, D. C.
Radiant Heating and Cooling Institute, Suite 318, 5657 Wilshire Blvd., Los Angeles 36, Calif.
Refrigeration and Air Conditioning Contractors Association, 1632 K St., N.W., Washington 6, D. C.
Refrigeration Industry Safety Advisory Committee, 1346 Connecticut Ave., N.W., Washington 6, D. C.
Refrigeration Service Engineers Society, 433 N. Waller Ave., Chicago 44, Ill.
Refrigeration Trade Association of America, Room 513, Perpetual Bldg., 1111 E St., N.W., Washington 4, D. C.
Sheet Metal and Air Conditioning Contractors National Association, Inc., 107 Center St., Elgin, Ill.
Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.
Society of Fire Protection Engineers, 60 Batterymarch St., Boston 10, Mass.
Society of the Plastics Industry, Inc., 250 Park Ave., New York 17, N. Y.
Steam Heating Equipment Manufacturers Association, 5200 W. Clinton Ave., Milwaukee 18, Wis.
Steel Boiler Institute, Inc., 1308 Land Title Bldg., Philadelphia 10, Pa.
Stoker Manufacturers Association, 307 N. Michigan Ave., Chicago 1, Ill.
Sump Pump Manufacturers Association, Mills Bldg., Washington 6, D. C.
Tubular Exchanger Manufacturers Association, Inc., 53 Park Pl., New York, N. Y.
Underwriters' Laboratories, Inc., 207 E. Ohio St., Chicago 11, Ill.
Uniform Boiler and Pressure Vessel Laws Society, Inc., 95 Liberty St., New York 6, N. Y.
United Association of Journeymen & Apprentices of the Plumbing & Pipefittting Industry of the United States and Canada, United Association Bldg., 901 Massachusetts Ave., N. W., Washington 1, D. C.
Valve Manufacturers Association, 60 E. 42nd St., New York 17, N. Y.
Vertical Turbine Pump Association, 400 Citizens Bank Bldg., 16 N. Marengo Ave., Pasadena, Calif.
Warm Air Heating Institute of Northern California, 870 Market St., San Francisco 2, Calif.
Western Air Conditioning Industries Association, 3443 S. Hill St., Los Angeles 7, Calif.

Winning the Air Conditioning Odor Fight

Round 5: *Give Him Some Air!*

● In the January through April articles in this series, the author has discussed the ability of the human nose to detect odors both qualitatively and quantitatively, the physical properties of odors themselves, and the effects that temperature and humidity have on odors. That is to say, he has stated the problem. But what can we do about it? Ventilation, as a means to reduce odors below their thresholds, can be used in cases where outdoor air flow rates can be kept to reasonable levels. Actually, odor problems and required ventilation rates for removal can be calculated before air conditioning is installed by following some simple mathematics. Then evaluation of other factors will determine whether or not ventilation is the answer.

Mr. Hubbard was a long time member of the ASHAE Technical Advisory Committee on Odors and its chairman during 1956 and '57. He was associated with General Electric Co.'s air conditioning department for many years and has had much experience in the design and installation of air conditioning.

BY ALBERT B. HUBBARD

YOU, the odor investigator, must cure an air conditioning system in odor trouble. What to do? Armed with the knowledge presented in the four preceding articles in this series, you think: "Why not reduce the odor to below the threshold with outdoor air?"

The most striking fact of life about outdoor air is that ventilation must be stepped up geometrically to produce arithmetic reductions in odor level. The basic theory and experimental data have long been in literature[1,2], but the implications are not well known. We will hurry through the mathematics in order to put more stress on the conclusions:

Odorant physical concentration is linear with respect to ventilation rate. This can be expressed in the steady state case as:

Odor produced = odor carried out by ventilation air
$= C_1\ (\text{cfm})_1$
$= C_2\ (\text{cfm})_2$

where:

C = concentration of odorant in weight per cubic foot of room air
cfm = ventilation air leaving
$_1$ and $_2$ = different ventilation rates.

Therefore, for a given odor production rate:

$$C_1/C_2 = (\text{cfm})_2/(\text{cfm})_1 \quad [1]$$

The nonlinear feature enters by way of the Weber-Fechner law, usually stated "Sensation is proportional to log of stimulus." A little mathematical manipulation produces a convenient form of the law:

$$C = aK^{10/S(OI)} \quad [2]$$

where:

C = physical concentration of odorant
a = constant to take care of threshold and dimensions of concentration
S = number of equal steps in complete sensation scale
OI = odor sensation index
K = Weber-Fechner constant[3], ranging from 1.4 to 3.5.

Substituting, we can relate odor index and ventilation rate:

$$K^{(10/S)(OI_1-OI_2)} = (\text{cfm})_2/(\text{cfm})_1$$

Literature evidence indicates that a higher value of K is a good choice for the mixed odors in air conditioned spaces. We will use a five-step sensation scale (see next page). The equation becomes:

$$(K^2)^{(OI_1-OI_2)} = (\text{cfm})_2/(\text{cfm})_1$$

$$10^{(OI_1-OI_2)} = (\text{cfm})_2/(\text{cfm})_1 \quad [3]$$

Now it is apparent that if we want to go down one step on the odor sensation scale, the new ventilation rate must be 10 times the present rate. To improve a second step, 10 more times increase is needed, a total of 100 times, etc.

A good intensity scale is as follows[1]:

Odor index	Description
1	Recognizable
2	Moderate
3	Strong
4	Very strong
5	Intolerable

These five steps, used by the layman, are *significant* differences. An "expert" can divide the same range into 10 steps, which are *perceptible* differences. More than 10 steps are impossible because of the human nose's limitations. From the equations, we see that a ventilation increase of little over three to one achieves a *perceptible* improvement: an increase of 10 to one, a *significant* one.

The law works the other way to encourage outdoor air chiseling. When trying to underquote a competitor, figure 150 cfm ventilation instead of 500 and specify a 3 ton unit instead of a somewhat oversized 5 ton. The result is just *perceptibly* worse than good practice. But, if the extra odor sources were heading the case into a perceptibly worse result, then it may wind up *significantly* worse than average.

Forecast Odor Results

Using Equations 1, 2, and 3, an odor investigator can forecast results in nearly all ventilation situations. To clarify, here are four examples of their uses:

Ventilation to take care of extra odor sources must be directly proportional to their production rate, as stated in Equation 1 and the basic equation from which it was derived. Double the odor sources, e.g., invite twice as many smokers to your party, and you must double the ventilation to maintain the same odor level.

The odor production rate must increase 10 times to make a significant (one step) increase in the odor level, all other things including ventilation being constant. Equation 2 also makes the reverse clear: odor production must be cut to one-tenth to reduce the level significantly, and to about one-third to reduce it perceptibly. The moral here is: the difference between good and bad odor performance is not a trivial, hard-to-measure thing. You are looking for differences measured by factors of 10.

Odor results can be predicted before air conditioning is installed, based on Equation 3. Check the store at morning opening. The closed building probably has less than one-half air change per hour. Check it again during the day, judging odor level and the air changes caused by open doors and windows, exhaust fans, etc. If morning odor, at one-half change, is strong, and daytime odor, at five changes, is moderate, air conditioning will result in a level in between, near the high side. Certainly, this is not an improvement.

Removing odors at or near their sources is good advice suggested by common sense and Equation 1. Odors are removed by air *leaving* the premises, so place air exhausts at points of greatest odor production to get the most out of a given ventilation rate. An example common in restaurant practice is the use of hoods over ranges and steam tables.

Ventilate at Night

Secondary odor sources also rear their ugly, often forgotten, heads into the ventilation picture. We see cigarette smoke and regard it as the sole source of tobacco odor. We conclude that, because no one is there to smoke, no ventilation is needed in a store after business hours.

Smoke consists of small droplets of tarry substances formed by poor combustion. These droplets attach themselves to surfaces and slowly evaporate to produce the most objectionable stale tobacco odor. In general, the same mechanism works on cooking food fumes.

Three practices can alleviate secondary odors:

1) Catch as many droplets as possible, before they deposit, by using high performance air cleaners.

2) Practice good housekeeping. Avoid surfaces that cannot be scrubbed, laundered, or dry cleaned. Do thorough cleanings regularly.

3) Take advantage of nighttime ventilation.

The first two points are obvious but the third apparently is not. It is rarely practiced. An exhaust fan capable of supplying 10 to 20 air changes an hour represents a small percentage increase in equipment price, but it can greatly improve odor conditions. Looking at it on a 24-hr basis, nighttime ventilation can increase the amount of outdoor air admitted 30 to 40 times. Also, night air is usually a good thermal bargain, so that the store with off-hour ventilation is cool as well as fresh at opening time.

Outdoor air hurts economically in two places. It increases required cooling capacity by 1 ton per 400 cfm on a standard day. It also increases operating cost proportionally as outdoor temperature rises above room level.

These monetary drawbacks can be avoided by extending the 24-hr idea to include the season as a whole. Suppose a reasonably sized exhaust fan, providing five to 10 air changes per hour, is controlled by the thermostat so that ventilation is *on* only when the compressor is *off*. No outdoor air component need be considered in sizing the air conditioner because none appears at the peak cooling load. The outdoor air's operating cost is minimized because its average flow is lower as peak cooling is approached. In fact, on many days outdoor air is cooler than room level and can be used to satisfy solar and internal heat loads, thus cutting compressor operation.

I'll close with this one last word: Ventilation can be used only in odor problems where the rate won't be so great as to blow everything out of the room.

Next month: cooling coil odors. ‡

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[1] *Ventilation Requirements for Cigarette Smoke*, by C. P. Yaglou. Heating, Piping & Air Conditioning, January 1936.

[2] *Minimal Replenishment Air Required for Living Spaces*, by W. V. Consolazio and L. J. Pecora. Heating, Piping & Air Conditioning, March 1947.

[3] *About Odors — Their Nature, Cause, and Control*, by F. H. Munkelt. Paper presented at American Society of Refrigerating Engineers' annual meeting, December 1945.

INDUSTRIAL VENTILATION:

How to Design Freeze Protection For Makeup Supply Air Systems

BY JOHN H. CLARKE
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Air Conditioning and Power
Visking Co.
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● Freeze protection is a "must" for steam heated industrial supply air systems. Controls for these systems must regulate against underheating and overheating, especially in mild weather. Control valves must be carefully sized, and thermostats must be located at points where they can sense properly the temperatures they are assigned to control. Freezestats are desirable, but are no positive protection against freeze-ups. Outside and return air dampers, where used, should provide impingement and thorough mixing of the two air streams to prevent stratification. Several types of control systems are used in industrial plants today. The author takes a critical look at some of these.

Mr. Clarke has had many years' experience in the heating, piping, and air conditioning field. A graduate marine engineer from the University of Michigan, he has served in engineering positions with Gibbs & Cox, naval architects, New York City; the U. S. Maritime Commission; Marinship Corp.; and Standard Oil Co. of Indiana and has held his present position for the past six years. He is the newly appointed chairman of the Research Advisory Committee on Industrial Environment for the ASHRAE. Author of many articles for Heating, Piping & Air Conditioning on various aspects of design, operation, and maintenance of heating, ventilating, and air conditioning equipment and systems in industrial plants, most recently he has written on the subject of industrial ventilation in the April through November 1958 and April 1959 issues. If you haven't already, you should read these straightforward approaches to industrial ventilation design.

THE CONTROL METHODS for steam heated industrial supply air installations differ from conventional systems mainly in that either a large percentage or all of the air circulated is from outside. Such systems must be carefully designed to provide freeze protection. With the type of equipment available today, there is no need to sacrifice good control in order to obtain this. Consequently, we should take a fresh look at the basic design requirements of our control designs where industrial supply air systems are involved.

As a good start, let's review the ground rules for good design: To begin with, the system should *control*. This means regulating against underheating and overheating. The latter point seems to escape some engineers and operators. There is a long history of systems which have been assumed to be operating properly but were in fact overheating in mild weather. The hot plant conditions were attributed to internal heat, until checks of the system discharge temperatures proved the contrary.

With present-day process and equipment loads, few plants require heating (supply air above room temperature), and even then the final temperatures are surprisingly low. Other plants may require cooling (supply air lower than room temperature) most or all of the year. Ten industrial systems were checked in a plant last winter when the outside temperatures were in the range of zero to −10 F. Supply air temperatures varied from 60 to 87 F. Most systems were around 70 F.

Where heat recovery is provided by mixing supply air with warm internal air, the supply air temperatures will be on the low side, with appreciable savings in the fuel bill. For the reasons just mentioned and because practical locations for room thermostats are seldom available, a large percentage of industrial supply systems are controlled to provide tempered air.

There are many other factors to the design problems. Some of these are noted herein.

Must Control Light Steam Loads in Mild Weather

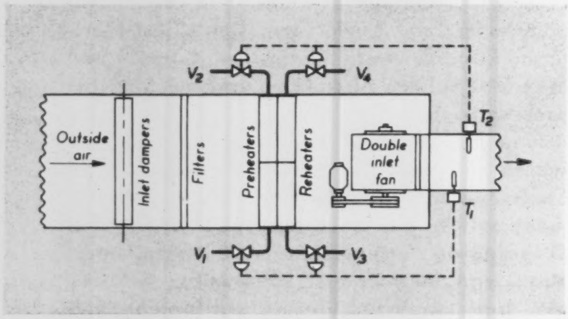
Control valves should be of the normally open, single seated, dead-end type, with plugs or v-ports properly designed to control the light steam loads at the specified steam pressures. Heating system loads vary from *zero* to *maximum* and even *small* leakage at shutoff can cause annoying overheating in mild weather.

It is essential to avoid oversizing, as this causes hunting and overheating. The valves should be carefully sized for the load, steam pressure, and the desired pressure differential (pressure drop across the valve). For good control a pressure differential of about 50 percent of the initial steam pressure is customary. The valves must be sized to fit the operating capacity requirements of the air heaters they control.

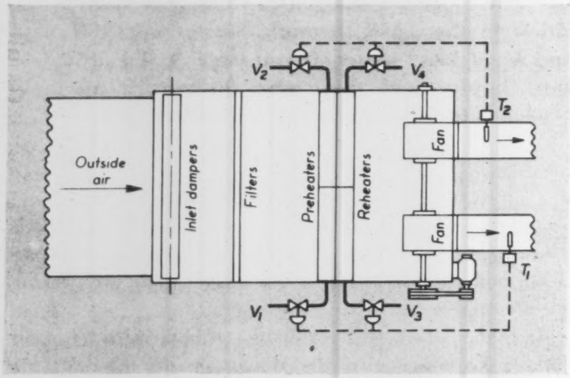
A little undercapacity of the preheater valves is desirable in some cases to prevent oversizing, provided this will not handicap the necessary heater performance and the reheater valves are sized to handle the additional capacity requirements. This is one way to avoid overcapacity. Overcapacity of the preheater valves, beyond the heater capacity, is of no value and the reheater valves must still be sized for their specific heater load.

Air heaters in series should never be controlled by a single valve. Provide at least one valve for the preheater sections (all preheaters would be served by this valve), and one for the reheater sections (all reheaters served by this valve).

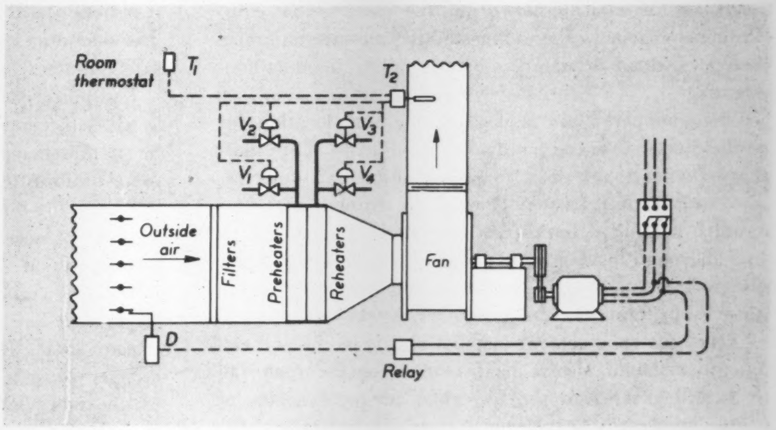
Large systems will require two valves for the preheaters and two for the reheaters. Where two valves operate in parallel it is common practice to size them for one-third and two-thirds of the load, respectively. All modulating valves, particularly when sequenced, should be positively positioned. This is inherent in electric motorized valves. For pneumatic systems, large diaphrams will



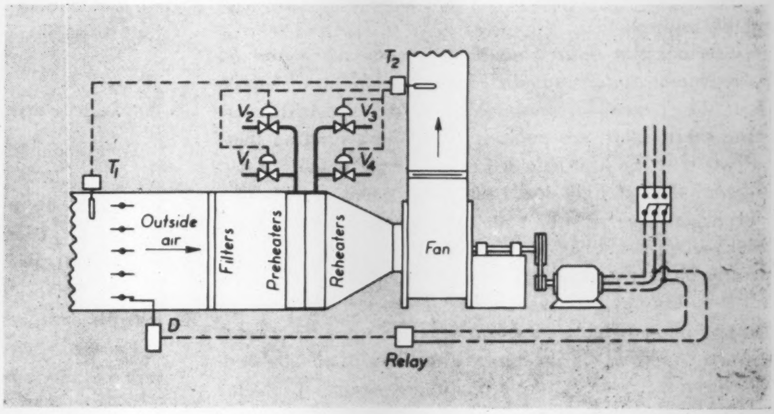
1 FOR LARGE SYSTEMS (100,000 to 200,000 cfm) where air heaters would be undesirably long, freeze protection, less stratification, and better control are obtained by installing shorter heaters end to end and dual control systems, one for each half of system casing, controlled by complimenting fan discharge thermostat



2 WHERE LARGE PACKAGE air handling units are used, heater sections and controls should be divided in same manner and for same reasons as for system shown in Fig. 1



3 ROOM THERMOSTAT and sequence valve control for preheaters and reheaters shown here. This is believed to be simplest, most reliable control system. It also provides excellent freeze protection. For this system, valve V_1 must modulate wide open before valve V_2 starts to open. V_3 and V_4 open in like manner. Submaster thermostat T_2 in fan discharge is necessary to provide freeze protection. If room thermostat alone is used, 2 F deg adjustment in setting could close steam valves, endanger air heaters, and cause discomfort in area until equilibrium is reached. Lock or key type room thermostats are very desirable for such systems. Outside air dampers are connected to close on fan shutdown



4 SEQUENCE CONTROL of air heater controls as in Fig. 3 but with outside air master (T_1) and duct submaster (T_2) thermostats shown here. Outside air control provides adjustment of system discharge air temperature with changes in outside air temperature. Many industrial areas, because of building construction, internal heat loads, and equipment locations, do not lend themselves to control by room thermostats

be ample for small systems having single preheater and reheater valves. For larger systems or systems having more than two pneumatic valves, positive positioning relays should be provided.

A suggested schedule for the number of valves to be provided for a system is as follows:

Total required steam capacity, lb per hr	Number of preheat valves	Number of reheat valves
To 1000	1	1
1000 to 1800	2	1
Over 1800	2	2

This schedule can be further refined for very large systems of the 100.000 to 200.000 cfm class using double inlet fans by dividing the heater control in the middle of the casing (Fig. 1). At least one control valve, controlled by its own thermostat on the same side of the fan discharge duct, would control the preheaters on that side. Similar control would be provided for the preheaters on the opposite side, and for each of the two sides of the reheater section. This reduces stratification, branch takeoff problems (because of temperature differentials), and the possibility of freezing. For large multi-fan package type air handling units it is wise to divide the air heaters and control them in the same manner (Fig. 2).

Locate Thermostats to Best Advantage

To control, the thermostats must be located at points where they can sense properly the temperatures they are assigned to control. This is not always easy. In large spaces no representative location may be available for a single room thermostat, and several averaging room thermostats may be required.

Another means for obtaining room control was used in one industrial area. The directional supply outlets were turned parallel to the walls (similar to the propeller type unit heater arrangements frequently used) to cause a rotation of air around the space. This permitted a thermostat at one end on an inside wall to do a very good job.

Where room thermostats are provided, they should be backed up by submaster thermostats in the system fan discharge (Fig. 3). If a room thermostat is adjusted as much as 2 F deg from the point at which it has been controlling, the steam valves will either go wide open or closed. Depending upon the capacity and extent of the supply system, it may be 5 min. or more before the room reaches equilibrium at the new temperature. In the meantime, with the heater control valve in the closed or nearly closed position, air heater freezing may occur at outside temperatures below 32 F. In addition, discomfort will arise from the cold air blown into the space before equilibrium is reached. The submaster thermostats minimize these unfortunate occurrences by controlling the duct temperature.

Where tempered air is desired, the best location for the thermostat is in the fan discharge (Fig. 4). Care must be used with double inlet fans or multiple fan units because stratification frequently will pass through such fans or units, making it impossible for the thermostat to control. Thorough mixing must be provided in the discharge duct by baffles, by a duct elbow, or, for multiple fan units, by bringing the ducts together, as shown in Fig. 5.

Except for split control installations (Fig. 2), a common duct should always be provided for the multi-fan air handling units to provide some adequate means of measuring the discharge temperature. In a straight discharge, mixing baffles and an averaging thermostat are the minimum requirements for, but no assurance of, reasonable control.

Only as a last resort should the control thermostat be located immediately downstream from the air heaters. Here, the chances for reasonable control, even with averaging thermostats, are poor. If used, the averaging thermostats must be heat shielded from the air heaters. Keep in mind that at light loads even the steam distributing tube heater may stratify both vertically and horizontally. Other factors such as poorly mixed return and outside air or uneven air loading passing through the heaters may cause additional variation in air temperature. This will make it impossible to control properly with a thermostat downstream from the heaters. Regardless of the thermostat location, never underestimate the control problems caused by temperature stratification.

Outside air thermostats should be shielded from the sun and should be located to avoid impingement by other than outside air. A good location is in an inlet trunk or canopy, or just inside the shutoff dampers for 100 percent outside air systems.

Freezestats No Positive Protection

Generally speaking, it is desirable to provide freezestats which will shut down the fans and close the outside air dampers in case of freezing conditions. Such conditions can be caused by steam, steam valve or trap failure, or by plugged strainers.

Probably the more reliable protection is provided by condensate freezestats, one for each heater drain of the preheater section, than by fan discharge air freezestats. The latter may be vulnerable because either temperature stratification or thorough mixing of the air stream may make it difficult for the unit to sense the freezing conditions.

Even a condensate thermostat may not act in time in case a line stoppage holds water in the heaters. Consequently, a freezestat is no *positive* guarantee against freezing.

For essential makeup supply systems it may be unsafe for the system to automatically shut down. In such cases it is better to arrange the thermostat to actuate an alarm. The operators can then stop the system and provide for safe contaminant removal from the building.

Equipment details will be discussed in a later article. It will suffice here to say that the preheaters at least should be of the steam distributing tube type so as to provide more uniform temperatures across the heater face and to minimize the possibility of freezing.

It is not necessary that the preheaters be fully loaded to capacity at 32 F outside air temperature to provide protection against freezing. An exception appears to be the case of face and bypass control where opposed dampers are used. Recent reports indicate air heater freezing damage caused by the high velocity impingement of air on the tubes when the face dampers are nearly closed, despite full steam pressure on the heaters. Except for such unusual conditions, a heater of the distributing tube type which is about 50 percent loaded is amply protected. If failure occurs, look for causes other than heater loading.

Arrange Dampers For Thorough Air Mixing

Where outside and return air dampers are provided, these should be arranged to facilitate impingement and thorough mixing of the two air streams. Lack of such mixing can cause stratification and control difficulties and resultant freezing.

The control design should be arranged to close the outside air dampers upon fan shutdown.

Face and bypass dampers should usually be of the opposed blade type. These provide better metering and, consequently, better control. The freeze problem previously mentioned, apparently caused by high velocity air impingement on the heater tubes, must be considered in the design and location of the dampers.

Check Out Control System Before Operation

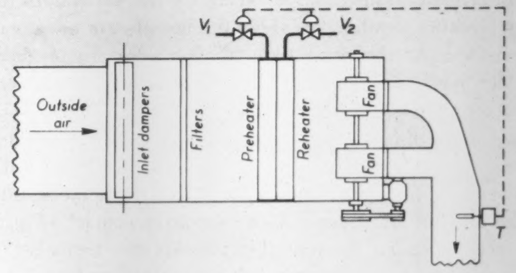
Prior to operation, every control system should be thoroughly checked to see that it is working as intended, that the proper valve sequence is obtained, and that any necessary sensitivity adjustments have been made to reduce or stop hunting.

Several unfortunate incidents come to mind: One system "operated" for two years with the heating controls set for reverse-acting instead of direct-acting before someone checked to see what was causing the chronic overheating. On a second system the sequence of the preheater and reheater control valves was reversed, causing the reheater valves to open first. The result was several very frozen tubes in one preheater section. Inner distributing tubes and good fortune saved the other heater sections.

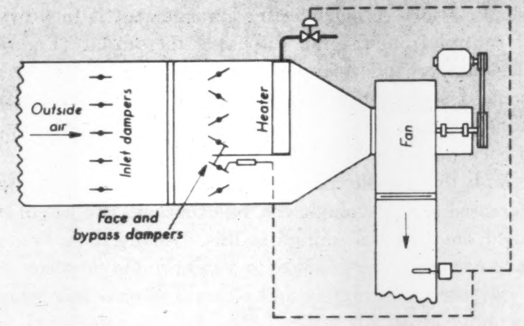
Types of Control Systems

Having reviewed some of the ground rules, let's look at some of the types of control systems and see what each has to offer.

5 WHERE MULTIPLE FAN, package type air handling units are installed, control and elimination of stratification will result if discharges are combined into single duct as shown. Wherever straight discharges are used, outlets should be combined. Mixing baffles and average thermostats at least should be used, but these do not necessarily assure complete elimination of stratification and possibility of control difficulty with this type of supply unit



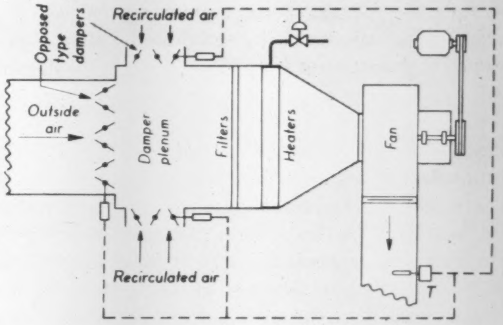
V_1
V_2
Outside air
Inlet dampers
Filters
Preheater
Reheater
Fan
Fan
T



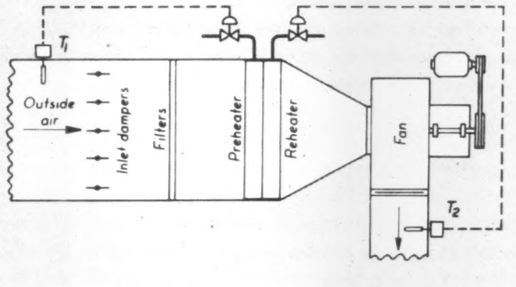
Outside air
Inlet dampers
Heater
Fan
Face and bypass dampers

6 FACE AND BYPASS CONTROL system provides freeze protection, but must be carefully designed to minimize overheating and control hunting in mild weather

7 MIXED AIR CONTROL is used on systems where outside air can be reduced to minimum required for makeup to area served. Control in fan discharge and sequence control of dampers and steam valve are recommended. With damper control thermostat located in inlet plenum, it is difficult to avoid hunting because of inability of thermostat to sense true mixed air temperature



Opposed type dampers
Recirculated air
Outside air
Damper plenum
Filters
Heaters
Fan
Recirculated air
T



T_1
Outside air
Inlet dampers
Filters
Preheater
Reheater
Fan
T_2

8 PREHEATER CONTROL by outside air thermostat illustrated at left. Thermostat T_1 is usually set to open preheater valves over range of 10 to 15 F (for instance, from 45 to 35 F) so that valve will be wide open at freezing conditions. Preheaters must be carefully selected to avoid overheating in mild weather. This is difficult or impossible when required area discharge temperatures are low (60 to 70 F), as they are in many industrial areas

- *Sequence Control of Preheat, Reheat Valves*

For those systems which operate continuously on 100 percent outside air, it is believed that sequence control of the steam valves (Figs. 3 and 4) is the simplest and most reliable. It will give excellent freeze protection and control when combined with properly selected components of the heating system. This system is arranged so that the preheater valve modulates and must be completely open before the reheater valve starts to open.

Where four valves are used, as in Figs. 3 and 4, V_1 will open first, followed by V_2, V_3, and V_4, as required. This arrangement assures ample steam on the preheaters during freezing weather, provided the heaters are not greatly oversized. At the same time, the temperature is always under positive control of the room or duct thermostat.

As previously mentioned, the duct control (Fig. 4) is used more often than room control (Fig. 3) in industrial areas, because tempering is usually sufficient and it is difficult to find practical locations for room thermostats. The outside air master, duct submaster control (Fig. 4) is recommended because this permits the tempered air temperature to be automatically increased or lowered, as desired, with changes in outside temperature, in order to approximate the inside requirements.

● *Face and Bypass Control*

Face and bypass control (Fig. 6) is widely used for freeze protection both for built-up and package type supply systems. Room control, similar to Fig. 3, or outside master-submaster control, similar to Fig. 4, may be used. One or the other is recommended. For this system, when heat is required, the modulating steam valve and the face dampers open in sequence, the steam valve starting first. The controls are set so that the steam valve will be wide open before 32 F outside temperature, and further control is provided by means of the face and bypass dampers. Where a preheater and a reheater are used in lieu of the single heater, the face and bypass and preheater valve and then the reheater valve should be controlled in sequence in the same manner as in Figs. 3 and 4. A control thermostat downstream from the preheater should not be used.

Dampers, even the opposed type, are not metering devices. Because their operation must overlap that of the steam valve in order for the latter to be wide open at 32 F, it is difficult to prevent hunting and overheating in mild weather with this system. The poor metering characteristics of the dampers cause appreciable change in system volume as the dampers modulate from the closed to the mid-position. The variation in volume will be much greater for ductless or low static supply systems than for systems having higher static duct distribution. In any plant in which air flow balance is being maintained for safe confinement of fumes and for fume removal, changes in system volume can cause considerable trouble.

When the bypass dampers are open (face dampers closed), the flow to the fan is poor with the arrangement of Fig. 6. This is another deficiency of the face and bypass arrangement. This problem can be alleviated by placing the bypass in the middle between two heater sections, as is done for some packaged propeller fan makeup units. But it is seldom practical for multi-fan centrifugal units.

● *Return Air-Outside Air Mixing Control*

In some plants, air handling systems are sized for the volume required for summer relief ventilation. In wintertime, the *outside air* is reduced to the minimum required for makeup to process and hoods. The rest of the system volume is recirculated.

By controlling the mixture, freeze protection and a considerable saving in heat load are effected, and 100 percent outside air is automatically provided in warm weather. The outside and return air dampers are set so that they do not close beyond the point required for minimum outside air. Such a system is indicated in Fig. 7.

For a minimum of 50 percent outside air, the mixture will be close to or above freezing at maximum load in all but very cold climates. Additional heating is provided by a single heater section. In some instances the temperature of the mixture has been controlled by a thermostat in the mixing plenum, and the air heater by means of a thermostat in the fan discharge. Control in the mixing plenum is not recommended because it is very difficult to measure the true mixed air temperature, and control hunting will usually result. A much better arrangement is to provide all control from the fan discharge thermostat (Fig. 7). The damper and steam valve control would then be sequenced so that the outside dampers would be at minimum position before the modulating steam valve begins to open.

With the outside and return dampers in mid-position, increased system volume can be expected. The use of opposed dampers will minimize this. Usually these systems have enough static pressure to minimize the problem.

Because the dampers and steam valve do not operate simultaneously, this system, where properly designed, will give stable control without overheating in mild weather.

● *Outside Air Control, Two-Position Steam Valve*

This system (Fig. 8) is a carryover from the old days when steam distributing tube air heaters were not available. It is still very popular. Strictly speaking, two-position preheater valves are not used because the sudden opening of such a valve causes undesirable thermal stress in the preheater, and rapid readjustment of the reheater control is necessary to maintain the desired temperature.

Usually the steam valve is opened by a proportioning thermostat, T_1, over a 10 to 15 F deg range. For example, as the outside temperature drops from 45 to 35 F. The reheater control valve would be modulated by means of the discharge thermostat T_2.

This type of control does provide freeze protection because the preheater valve is wide open at 32 F outside temperature. The method is simple in design and operation, but the preheater must be carefully selected to prevent overheating in mild weather. This is difficult to do when the required discharge temperatures are in the range of 60 to 70 F. Air heaters having temperature rise capacities of only 30 F are available. But it is well to consider that when this same heater is operating at minimum temperatures (−10 to −20 F), the discharge temperature is uncomfortably low. Freeze protection becomes marginal in such circumstances.

Because the reheater capacity must be cut back as the preheater is opened up, it is difficult to obtain stable control. This is another cause for overheating. ‡

Reference

Why Steam Coils Freeze, by H. W. Alyea. Heating, Piping & Air Conditioning, April 1958, pp. 104-107, and May 1958, pp. 127-129.

SAMUEL R. LEWIS, consulting mechanical engineer and a member of Heating, Piping & Air Conditioning's board of consulting and contributing editors, comments informally each month on practical problems in the field.

Sam
Lewis
says:

"Reheating the Air Supply Is a Well-Proved Air Conditioning Process"

LONG AGO I designed a complete air conditioning system for the general offices of a large corporation. The building comprised two duplicate stories with an open-well wide stair between them.

There was apprehension that in such a building the lower story would be too cool and the upper story would be too warm. The cooler air from the upper story was expected to flow down the stair while the warmer air from the lower story, weighing less, would collect near the top of the upper story.

Fortunately, the air delivery openings into both stories were located overhead at many strategic points. The plant continues in operation today after 35 years.

Of course, I would have liked doors at the stairwell at each story. In fact, I required them in the next similar project I designed in a structure that was six stories high.

Absence of trouble in this two-story plant suggests that excellent distribution of the cool air supply openings may be more important than the relative location of the outlets from the room for exhaust air.

There is another case in which a large single-story general office was served successfully by air supply and exhaust ducts and grilles in the ceiling. As the business prospered, it became necessary to build several partitions along the outer walls to form conference rooms.

It was necessary to arrange for maintenance of a temperature in each of these exterior rooms that would be warmer or cooler than that in the general office. It was not expedient to install separate air supply ducts for the exterior conference rooms. To do so would have required new ceilings and serious inconvenience in the general office.

It was possible, however, to install electric resistance heaters in branch ducts to conference rooms and to control these heaters by thermostats.

Thus, we could introduce all of the air for the general office, as well as all of the air for the conference rooms, from a trunk line duct. The general offices received more heat from electric lights and human occupants than did the conference rooms, and thus could accept air supply at a temperature somewhat cooler than that going to the conference rooms.

Use of the electric heaters in the conference room supply ducts proved successful. The owner has not objected to the alleged waste of refrigeration by first cooling and then reheating the air.

There exists today an entirely defensible tendency in air conditioning: first, cool the air to precipitate the moisture in the form of dew; then warm the dehumidified air to a comfortable temperature. Intelligent employment of refrigeration with subsequent reheating of the air supply is a well-proved process. ✣

How to Trouble-Shoot Regulating Valves

If you follow these few easy steps, you can expect years of troublefree service, with a minimum of maintenance

By ROBERT H. BROCK
Field Engineer
Spence Engineering Co., Inc.

REGULATING VALVES are one of the few classes of plant equipment that do not require periodic dismantling and overhauling. In fact, such maintenance is not recommended by most manufacturers of either externally or internally piloted regulating valves. Under ordinary conditions, if kept free of dirt, a regulator will function for years with a minimum of attention.

However, conditions are not always normal, dirt does get into the system, and human errors do occur. Since most essential parts of external pilot operated regulators are external to the main valve and are accessible, detecting and correcting malfunctions can be relatively easy.

Check New Installations

In the case of a new installation, it is well to check for accumulations of dirt after a few days of operation. Orifices in externally piloted regulators should be examined by uncoupling the tubing at the outlet side (Fig. 1) of the main valve.

The restriction orifice can be examined in some cases by unscrewing it from the underside of the main valve.

The inlet screen in both types of pilots may also pick up enough dirt in the first days of operation to warrant inspection. The removal of four bolts on the type illustrated on the next page will permit dropping the bottom cap which exposes the strainer (Fig. 2).

All joints should be inspected for leakage after the first few days. All bolts should be tightened. Under normal conditions with a strainer in the line ahead of the regulator, only an occasional inspection is required thereafter.

Make General Survey

If a regulator does not function properly on installation, check the original specifications to see that the correct valve and the correct pilot have been installed. Make an external examination of the station to see that the control piping is connected tightly and correctly (Fig. 3). Then check to see that there is sufficient steam pressure in the main line.

Next, check the adjusting spring on the pilot (Fig. 4). Cases have been reported of failure to adjust the pilot spring to the correct compression. The pilot is normally opened by the compression of the adjusting spring. If there is little or no compression imposed on the spring, the pilot will not open and steam cannot flow to open the main valve on the regulator.

Pneumatic or air loading of the pilot may be used instead of spring or weight loading. In this case, air loading pressure, which is comparable to the spring compression, can be controlled remotely. Since the air loading is normally gaged, it is easy to see whether correct loading has been applied.

Also check to see that the hand valves in the regulator station are properly set. The bypass must be closed. The control pipe valve must be open. Check to see that the stop valves on either side of the regulator are completely open.

Traps and other accessories to the regulating station should also be checked for proper functioning.

Orifices Dirty? Missing?

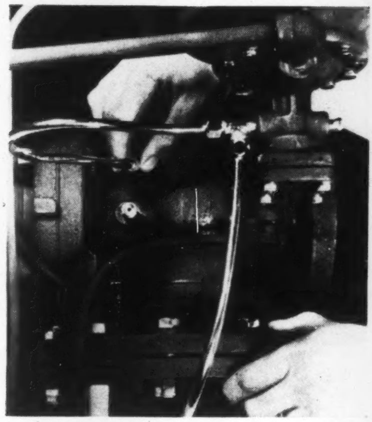
If the regulator fails to open, or if the pressure sags when a load is applied, it is most likely that one of the orifices is clogged with dirt or is missing. After closing both stop valves to isolate the regulator, break the pilot connections. There should be a restricted orifice in the pilot connections.

Lack of properly sized orifices can prevent the pilot from controlling the diaphragm pressure of the main valve as needed. To correct this condition, install an orifice of the correct size.

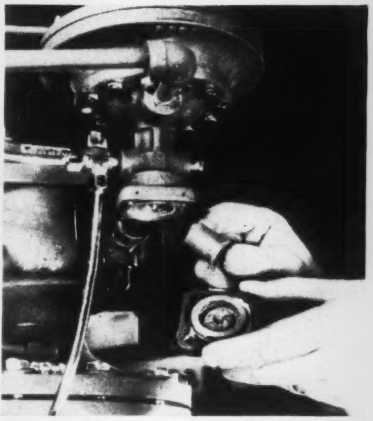
If the valve still does not function and is filled with a snubbing orifice, open the pilot connections at the orifice. If the orifice is clogged, the main valve will not move because there will not be pressure to move the diaphragm. The orifice and tube should be cleaned to remedy the trouble.

If these measures do not cause the valve to open, the pilot may be clogged. To find out, crack open the inlet stop valve after removing the bleedport bend (Fig. 6). Because the pilot is normally open, steam should issue from the tee freely. If there is little or no flow of steam, remove the square cap on the bottom of the pilot and clean the inlet screen.

If there is no evidence of a plugged strainer screen, re-open the inlet stop valve with cap still off to be sure steam is reaching the pilot

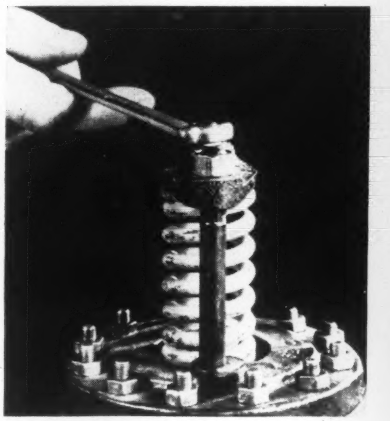


1 CHECK NEW VALVES after few days' operation. Uncouple tubing at orifices of external pilot regulators to look for dirt

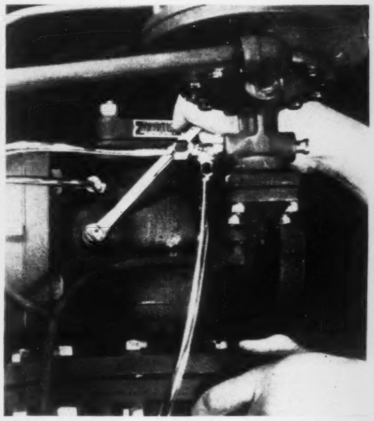


2 LOOK FOR DIRT at pilot inlet screen when provided on internal or external pilot types soon after installation has been made

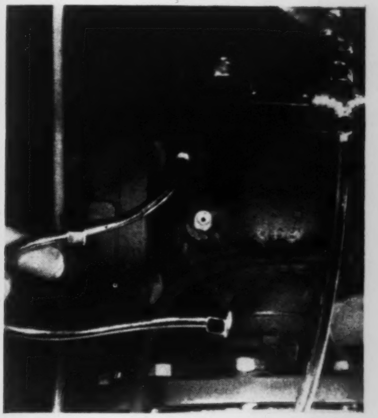
3 CHECK CONTROL PIPING to see if it is tightly and correctly connected. Internal check is made without removal from steam line



4 TEST ADJUSTING SPRING compression on pilot. If spring does not compress, pilot does not open to let steam flow through to open main valve



5 INSTALL CORRECT ORIFICE if regulator fails to open or pressure sags. Restricted orifice is found in pilot connections of external type



6 CRACK OPEN INLET stop valve after partially disconnecting pilot. Flow through opened connections indicates location of dirt

inlet. The $\frac{1}{4}$ in. pipe connections to the pilot may be plugged.

A plugged main line strainer with any regulating valve may pass enough steam to pass this pilot test while being enough of a restriction to cause a loss in pressure at the regulator inlet when a larger flow is required through the main valve.

If these efforts to open the main valve are unsuccessful, disconnect the control line and blow through it toward the outlet or downstream side to clear any obstruction.

In rare cases the main valve diaphragm may be broken or cracked sufficiently to pass enough steam to prevent a buildup of operating pressure.

Is Bleedport Obstructed?

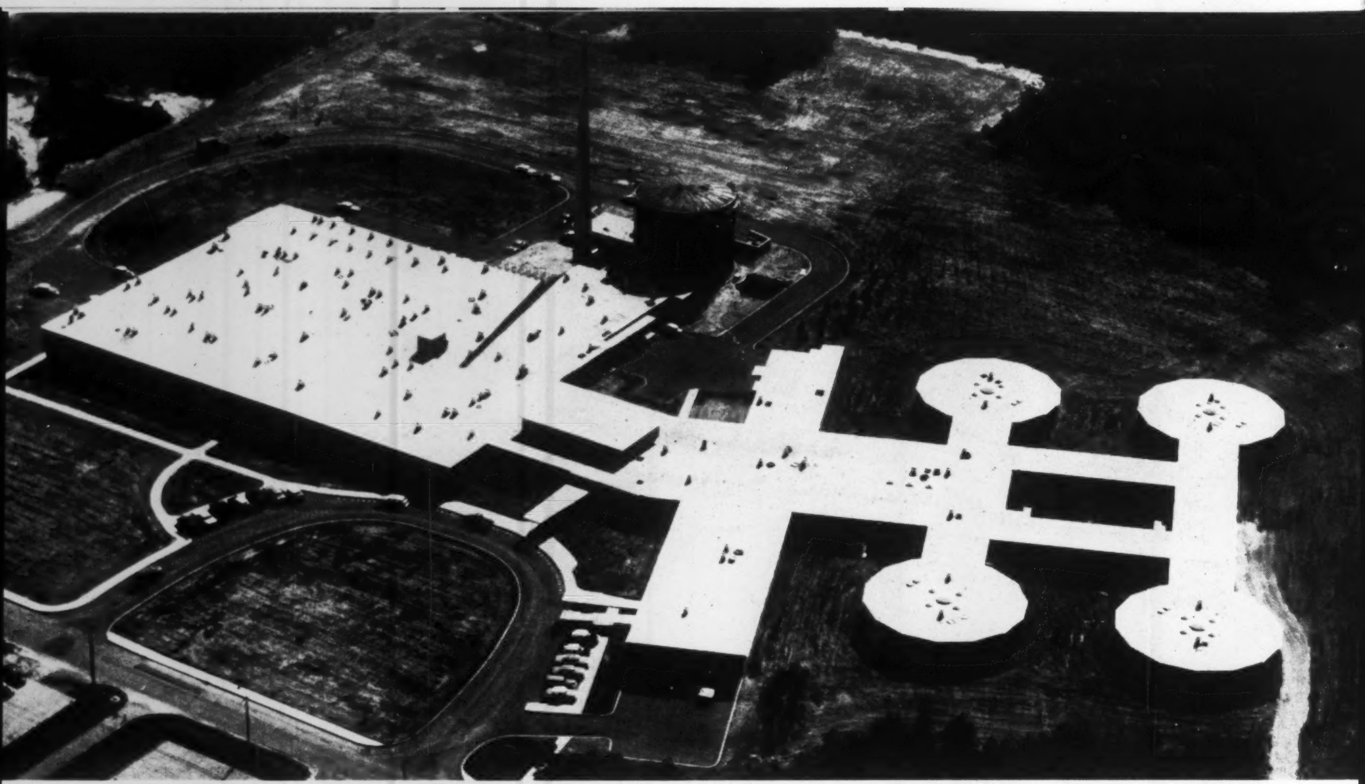
Another malfunction of regulators is "hunting" or failure to arrive at a stable condition. This can result from a partially obstructed bleedport. A hunting condition may occur when a regulator has been oversized and there is a large pressure drop or exceptionally light loads. This can usually be eliminated by changing the bleedport opening.

Sticking or binding in the operation of the pilot or main valve may cause hunting. This is caused by deposits of compound or foreign matter on the stems or guiding surfaces.

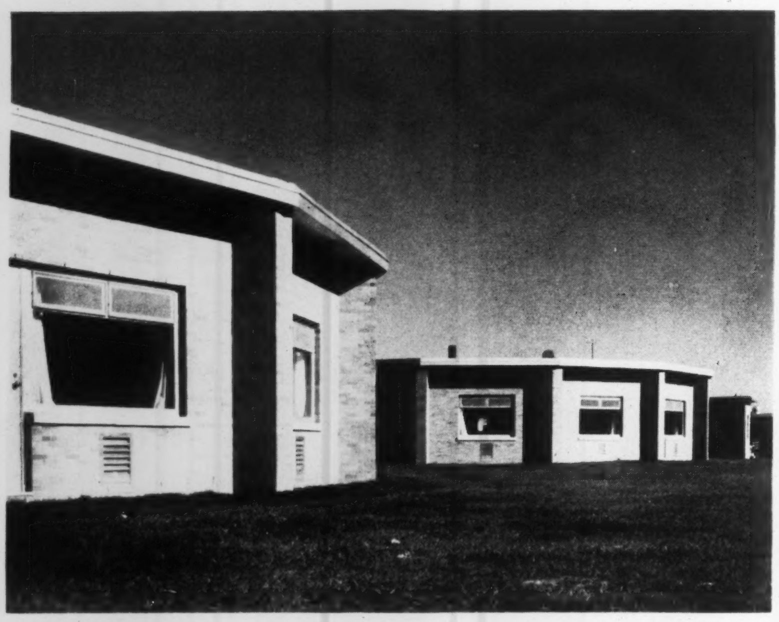
If two regulators are used in parallel, they should be set to operate at least 2 psi apart or both should be operated by the same pilot.

Especially with low delivery pressures, generally erratic control will result from leakage being forced to bubble through water pockets in an undrained control pipe.

In general, the procedures given should help to correct the great majority of malfunctions that may be encountered from time to time with regulating valves. When these procedures have been tried and the regulator still does not function correctly, it is well to keep in mind that too often a breakdown in the regulating valve is suspected when actually the valve is being interfered with by other factors in the installation. ≠



Brookhaven Hospital-Lab Demands



EACH ROOM in nursing area is heated, cooled by self-contained air conditioning unit. Simplified manual controls are operated by nurse on duty. About 25 percent outside air is admitted through inlet louvers under windows. Each unit, with nominal rating of 10,000 Btu per hr has hot water heating coil for winter operation

THE RECENTLY completed medical research center of the Brookhaven National Laboratory on eastern Long Island at Upton, N. Y., is a $6.5 million group of interconnected buildings designed especially for medical study and research.

The center consists of five separate areas, each dedicated to specific purposes but accessible to the others by corridors. These areas are: research laboratory, central facilities, industrial medicine, research hospital, and reactor building. The total area of these buildings is about 125,000 sq ft.

The research laboratory structure contains some 160 laboratories, offices, and rooms, plus 39 animal rooms and 10 dog pens. In the central facilities section is a large conference room, a library, and various administration offices.

The industrial medicine section, which contains examining and treatment rooms and the ambulance ga-

AERIAL VIEW of new Brookhaven National Laboratory medical research center shows four circular 12-bed nursing units at right, hospital service area at left. To far left is main laboratory building. Just beyond is cylindrical building in which reactor is housed, with stack for cooling air alongside

● Brookhaven National Laboratory's medical research center features a variety of heating, air conditioning, and ventilation systems to meet the diversified needs of this new hospital-laboratory installation. Perimeter areas are heated by finned tube radiation using 5 psi steam from Brookhaven's central power plant. Hot water heats the hospital area, via a two-zone reversed return system. Four air conditioning and five ventilation systems serve individual sections, according to need, including special cold rooms which require constant low temperature and humidity conditions. The use of 53 F well water, available at the site, reduces required mechanical refrigeration by two-thirds. The research center has the world's first nuclear reactor designed specifically for medical use. The design of the air conditioning system for the reactor building was a job in itself.

Mr. Babcock attended Ohio Northern University. For 12 years he was in the American Bureau of Public Works in Manila. Returning to New York in 1930, he engaged in design with several large engineering concerns and was with the Port of New York Authority for eight years. He joined the consulting engineering firm of Syska & Hennessy, Inc. in 1954 and worked with that firm on the design of these systems for the Brookhaven medical center project. Today he is associated with Magnesia Asbestos Insulation Co.

BY ARTHUR C. BABCOCK
Mechanical Engineer

Close Temperature, Humidity Control

rage, is located in a wing north of the research hospital area. This latter area includes operating rooms, X-ray rooms, a large physiotherapy section, doctors' quarters and offices, and four identical nursing units, each providing for the housing and care of 12 patients.

At the southwest corner of the research laboratory is the reactor building with its separate operating suite and the reactor or atomic furnace designed specifically for medical research.

The research laboratory, the hospital areas, including the industrial medicine, kitchen wings, and nursing areas, are all of one-story construction. A basement under the research laboratory contains the mechanical equipment, refrigeration plant, well pump and plumbing equipment, a morgue and autopsy room, and a large stack room for the library. The reactor building is a steel insulated tank 60 ft in diameter and 54 ft high. It also has a basement and mechanical rooms.

5 Psi Steam Heats Perimeters

In general, all buildings in the research center are provided with perimeter heating for all rooms and spaces along the exterior walls. Interior spaces are heated by means of the various air conditioning and ventilating systems.

The perimeter heating system for the research laboratory area consists of finned tube wall radiators supplied by 5 psi steam, while heat for the hospital areas is supplied by a two-zone hot water system.

The steam heating system consists of two zones—northwest and southeast—and is fully automatic. Steam is supplied to the entire center by the Brookhaven Laboratory power plant located about a mile away. It is furnished at 125 psi and reduced by pressure reducing valves in the various mechanical rooms: 5 psi for heating and 40 psi for other uses such as hospital and laboratory equipment.

The control of the steam heating system is of conventional design. When the outside air is below 35 F, the zone steam control valve is positioned by the average of the outside temperature, the inside temperatures, and the setting of an adjustable switch. When the outside air is above 35 F, the zone steam control valve operates as a two positioned valve to maintain the desired inside temperature.

All radiators are equipped with orifices. Return is by gravity to a vacuum pump, and the condensate is pumped back to the power plant. Some radiators in special laboratories are controlled by individual room thermostats.

The installed steam radiation system totals approximately 2300 EDR, with most of the finned tube radiators being one row high. All radiators

Cool Reactor Building with Unique System

Probably the most unique of the air conditioning systems serving the Brookhaven Laboratory medical research center is the one provided for cooling the reactor container operating and control room spaces. It also assists in cooling the reactor pile itself.

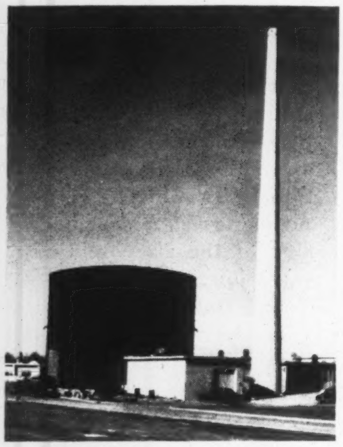
The reactor container is a steel tank about 60 ft in diameter and 54 ft high. It is insulated with 2 in. of foamed glass and has an exterior facing of corrugated aluminum.

The tank container is airtight and is designed to withstand 2 psi internal pressure. In the center of this tank is the reactor, or atomic furnace, which will be fueled by an alloy of enriched uranium and pure aluminum. This reactor, which is designed specificially for medical use, has a rating of 1000 kw.

Although the reactor is primarily water cooled, it was proposed to use the conditioned air at the work and control spaces in the reactor tank to augment the cooling of the pile. The conditioned air from the container areas is drawn through some 320 holes, 11/16 in. in diameter, and other small openings in the graphite blocks which surround the water cooled pile.

According to data furnished by the Brookhaven engineers, an exhaust fan able to handle 9 in. negative and 6 in. positive static pressure is required to draw the air through the graphite block and discharge it out of the 150 ft masonry chimney to the atmosphere.

The air conditioning supply unit (RAC-1 in Table 1) for the reactor is located in a basement mechanical room adjacent to the reactor tank. The system consists of an automatic roll type filter, preheat coils, well water cooling coils, chilled water cooling coils with duct reheat, and steam humidifiers in each branch.



COOLING AIR for reactor's graphite reflector is forced out of 150 ft stack. Steel reactor building, 60 ft in diameter, is connected to main medical research complex

Instead of through the usual outside air louver and damper, the outside air enters the unit through a special butterfly damper that can be shut tight in 1½ sec by compressed air from the reactor operating console located in the control room.

Some of the conditioned air from this unit is supplied to the reactor operating room suite which is adjacent to the reactor tank. The remainder is supplied through diffusers and grilles to the reactor container tank, work area, control area, and to two special concrete chambers, one for patients and the other for animals.

All the conditioned air is exhausted through the graphite blocks, down through a 24 in. steel pipe to a 24 in. cement-asbestos pipe under the basement floor, and then to an exhaust fan room on the east side of the reactor. This exhaust pipe also has an air operated butterfly damper where it enters the fan room. The exhaust air then passes through an aluminum casing containing special filters. Two 25 hp exhaust fans, one of which is a standby, draw the air from the reactor container and pile and out to the 150 ft stack.

The air exhausted from the reactor operating suite also passes under the basement floor from a separate exhaust fan and is discharged to the stack in the same manner through a butterfly damper.

This exhaust system also has its own radioactive filters.

The purpose of the complex arrangement of this exhaust system is to prevent any escape of radioactive or contaminated air to the atmosphere in the event of an accident in the reactor pile.

A 20 ton refrigerant No. 12 package chilled water unit serves the reactor air conditioning system. The 25 hp unit has its condenser cooled by the well water from the well water coils.

The control of this system is conventional except for the butterfly dampers at the outdoor air inlets and exhausts. Interlocks are provided so that the exhaust fan cannot operate unless the supply fan is started, and the butterfly valves open or close when the exhaust fans are started or stopped.

Other controls are provided so that the supply fan, exhaust fan, and all butterfly dampers can be instantly stopped or closed by the reactor operator at the control console. Separate ventilation units and unit heaters are provided for the fan room.

A system of air operated doors to the reactor tank container and water operated seals is provided to prevent any escape of radioactive air in case of accident, and the entire reactor system is completely separate from any of the other systems.

are concealed by covers. which for purposes of symmetry can accommodate radiators three rows high. Some two-high and three-high fin radiators are made up of 1¼ in. steel pipe with 4¼ by 4¼ in. steel fins.

Heat Hospital with Hot Water

The hot water heating system for the hospital area is a zoned, fully automatic. reversed return type. Zones are northwest and southwest. Each zone has its own converter. expansion tank and circulating pump. A standby pump is provided so that. should either of the zone pumps fail. the standby can take over the load.

The radiators are of the finned tube type. similar to the steam heating system. and are sized on the basis of 200 F average water temperature. The long exposed corridors leading to the nursing units have cast iron baseboard type radiators utilizing the hot water system. The nursing rooms are heated by means of hot water coils located in the self-contained air conditioning units.

The northwest zone is served by a converter with a rating of 1.155.000 Btu per hr and a hot water pump of 116 gpm capacity. while the southeast zone converter has a rating of 1.061.000 Btu per hr and has a hot water pump capacity of 106 gpm.

The control of these hot water heating systems is standard. A submaster thermostat in the converter discharge modulates the converter steam supply to maintain a predetermined discharge water temperature. When outside air is −10 F. the water temperature is 200 F. and with an outside temperature of 65 F. the water temperature is 100 F. These settings can be changed as desired.

Night control is similar except that a separate submaster thermostat with a lower temperature range is used. An automatic manual switch is used to raise or lower the submaster control settings.

A hot water radiant panel system heats the 10 dog pens in the laboratory area. Designed to maintain the dog pen floors at an adjustable temperature of 60 to 80 F. the system is automatic. except that the water circulator is started and stopped manually. The pipe coils are embedded in the terrazzo floor slab.

Melt Snow from Dog Runways

Each of the dog pens has an outdoor fenced-in runway which has a snow melting system. This system is similar to the radiant heating system except that it uses a 40 percent solution of ethylene glycol and has an open expansion tank (which is also used for mixing the solution). Piping for both the radiant heating and snow melting systems is all welded wrought iron.

Well Water Cuts Cooling Costs

The research laboratory building is served by air conditioning systems LAC-1 and LAC-2. and ventilation systems LV-1 and LV-2. as listed in Table 1. The supply units for these systems are located in the basement along the east wall of the building.

Both the air conditioning and ventilation units are of conventional design: the former with filters. preheat coils. well water cooling coils. chilled water coils. and individual duct reheat coils. The ventilation units are similar except that they have no chilled water coils and the reheat coils are in the units themselves. except for a few special cases.

TABLE 1 — **FOUR MAIN** air conditioning systems and five ventilation systems serving Brookhaven National Laboratory research center are given here

System	Type	Location	Air supply, cfm	Area served
LAC-1	Air Conditioning	Basement	14,155	Lab area and animal rooms
LAC-2	Air Conditioning	Basement	16,215	Lab area labs and offices
HAC-1	Air Conditioning	Basement	2,615	Hospital area rooms
RAC-1	Air Conditioning	Reactor basement	7,890	Reactor
LV-1	Ventilation	Basement	50,435	Lab area labs and offices
LV-2	Ventilation	Basement	48,740	Lab area labs and offices
HV-1	Ventilation	Basement	14,100	Hospital rooms and offices
KV-1	Ventilation	Basement	12,650	Kitchen
CV-1	Ventilation	Basement	12,380	Conference room and library

In general. the ventilation systems supply all the corridors. rooms. and offices which are not required to be fully air conditioned. These systems might be called tempered air conditioning systems. and they depart from the conventional in that they are supplied with well water coils for precooling the air supply.

Since well water was available at the site at a temperature of about 53 F. it was found. after study. that the use of this water for cooling would reduce the required mechanical refrigeration by about two-thirds.

The research laboratory area has a gross area of 57.400 sq ft. of which 13.480 sq ft (or 23.6 percent) is fully air conditioned. If this were to be conditioned with mechanical refrigeration. a total capacity of 300 tons would have been required. However. by using well water for precooling. a refrigeration machine of 100 ton capacity is ample.

The present well pump has a capacity of 1250 gpm and is located at the northeast corner of the building. For the reactor core cooling. 300 gpm is required. The balance of 950 gpm is available for precooling in the air conditioning and ventilation systems.

The three ventilation systems—LV-1. LV-2 and HV-1 shown in Table 1—have four rows of well water cooling coils. with space provided in the casing and capped tees in the piping for the future installation of eight additional rows of coils.

All air conditioning and ventilation systems are 100 percent outside air systems. except the one for the conference room system (CV-1 in Table 1). In all systems except that one. vitiated air is removed from the building by 115 direct driven centrifugal room exhaust fans.

Of a total of approximately 40 chemical and fume hoods. 14 are provided with filters for removing radioactive chemicals and fumes.

The roof exhaust fans are driven by air cooled motors with sealed lubricated bearings for continuous duty. and have aluminum hoods and casings. The laboratory exhaust fans have wheels. casings. and interiors furnished with baked-on corrosion-proof coatings.

How Control System Works

The control system for the air conditioning units functions as follows:

In summer, a thermostat in the supply fan discharge maintains the desired temperature by modulating the well water coils and chilled water coils in sequence. Individual room thermostats and hygrostats control the respective steam reheat and humidifier valves.

In winter the discharge thermostat modulates the preheat and reheat steam valves in sequence, and a thermostat on the leaving side of the preheat coils will overcall the discharge thermostat when the outside air is below 46 F. When the supply fan starts or stops, the outside air damper opens or closes. In the latter event, all modulating valves on the well water, chilled water, humidifier, and reheat coils close. The preheat coil is always under control of its thermostat during winter operation.

Control Systems Have Interlocks

An unusual feature of all the air conditioning and ventilating systems is that interlocks are provided so that if the unit supply fan is stopped, all the roof exhaust fans operating in conjunction with the supply fan will also stop. The roof exhaust fans have starters with hand-off-automatic switches so that they can be operated manually if desired, even if the respective supply fan is idle.

The air conditioning system for the animal rooms likewise has an unusual feature: The pampered inhabitants of the laboratory are rats and mice which are used in large numbers for research purposes. Their health, comfort, and environment are of paramount importance. The air conditioning system (LAC-1 in Table 1) which supplies the animal and breeding rooms is equipped with an auxiliary valve which allows city water to flow into the well water coils in the event of failure of the well water pump.

A further safeguard to insure that the rodent population is kept healthy and contented is the elaborate system of alarms in the animal rooms. If the temperature or humidity falls below or rises above certain set limits, an alarm rings and an area light appears on the alarm panel located in one of the nurses' stations. The nurse on duty will immediately contact the operating and maintenance staff to correct the condition.

The air condition of the animal rooms is to be maintained at temperatures and relative humidities adjusted from 72 to 80 F (± 2 F) with 50 percent RH (±10 percent).

Cold Rooms Critical

In the laboratory area are seven cold rooms where temperatures of 32 to 40 F must be maintained, with 50 percent RH maximum, and one subzero cold room kept at −4 F, with 30 percent RH maximum.

These systems employ chemical dehumidifier units using hygrol liquid in a spray type, frostproof system with direct expansion coils and a separate concentrator for reconditioning the solution.

The unit for the 32 to 40 F cold boxes has a 20 hp, refrigerant No. 12 machine with a suction temperature of −5 F.

The sub-zero cold room equipment is similar, except that the dehumidifier serves only the one cold room and has a 25 hp, refrigerant No. 22 machine with a suction temperature of −42 F.

Both of these systems are controlled by thermostats in the supply fan discharge ducts to the various cold rooms. The individual cold room conditions are maintained by room thermostats energizing or de-energizing electric duct reheaters.

All cold rooms have alarms indicating high or low temperature conditions. These are indicated in the same manner as the animal room alarms on the same panel.

All ducts and dehumidifier units are insulated with foamed plastic blocks, 4 in. thick for the 32 to 40 F rooms and 8 in. thick for the −4 F sub-zero room.

A 100 ton, 12 cylinder, refrigerant No. 12 refrigeration machine is located in the basement of the laboratory area. This unit, operated by a 100 hp motor, furnishes 40 F chilled water for the two laboratory systems and the hospital area unit (LAC-1, LAC-2, and HAC-1, respectively, in Table 1). The refrigerant is condensed by well water. The well water passes through water coils in the air conditioning units prior to entering the condenser.

The large kitchen has a ventilation system with no cooling coils. In summer this is operated with 100 percent outside air. In winter the discharge temperature is maintained at approximately 60 F by preheat and reheat coils. Supply air is exhausted through the large range hood.

The physiotherapy area is provided with a separate air conditioning system. A 10 ton self-contained unit utilizes ventilation air from the ventilating system supply. Conditioned air is supplied to the various rooms in this area with a steam nozzle humidifier in the unit and steam reheat coils in the various ducts controlled by individual room thermostats. All vitiated air is removed by the roof exhaust fans.

Each of the 48 patient rooms in the four nursing units (12 in each) is furnished with a self-contained air conditioning unit located under its window. Each unit, with a rating of 10,000 Btu per hr, has a hot water heating coil for winter operation.

The units have three-speed evaporator fans with simplified manual controls that can be operated by the nurse to furnish heating, cooling, or ventilation only, as desired. Control is by a thermostat in the return air inlet, and approximately 25 percent outside air is admitted to the unit through the inlet louver under the window.

The center was built by the Atomic Energy Commission for the Brookhaven National Laboratory. The architects were Eggers & Higgins. The heating, ventilating, and air conditioning systems were designed by Syska & Hennessy, Inc., consulting engineers.

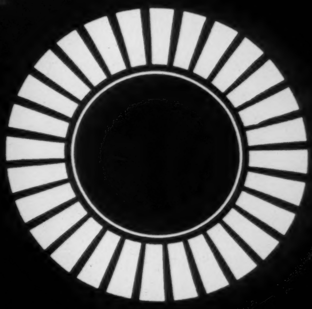
Some of the special features of the project, particularly the reactor air conditioning and cooling system, were designed in collaboration with the Brookhaven National Laboratory engineers. ╪

HPAC ENGINEERING DATA FILE

Application of Cork Insulation to Cold Pipe Lines

- *What thickness is needed?*
- *What 'accessories' are required?*
- *What installation methods?*
- *What type of supports?*
- *What maintenance procedures?*

By James H. Shaw



In designing and applying cork insulation for a particular job, several things should be given careful consideration. Among these are: the correct thickness for the intended service, obtaining a perfect fit to the pipe and fitting, proper loading at hangers, correct hanger design, and correct anchor design when used.

Once a good job of application is made, it is of vital importance to insure permanence of the insulation used. Among the items to be considered to prolong the life of the insulation are: a good vapor seal, protecting outside lines from weather, protection from impact and abrasion, protection of steel items — hangers and supports — by painting, and proper and periodic inspection and maintenance. These various considerations are discussed in this report.

The author joined Eastman Kodak Co. in Rochester, N. Y. after graduating from Clarkson Tech with a BSME degree. The information in this report is based upon his experience at Eastman Kodak where he spent 12 years in the utilities division and eight years as chief engineer of the refrigeration section of the power engineering department. In this latter position he was in charge of engineering, construction and initial testing of all major industrial refrigeration systems. Mr. Shaw joined Carrier Corp. as director of laboratory services in 1954. He is a member of a number of technical societies, including the National Society of Professional Engineers.

THERE ARE numerous insulation materials on the market today with several kinds well suited to each temperature range. Some insulations are suited for the entire cold range from anti-sweat to the ultra-low temperature service. Cork is one of these wide temperature range insulants.

This report does not attempt to justify cork over any other insulation. That must be the decision of the designer or user. Several papers have been published by others dealing with the installation of various insulations. This will deal only with cork.

Tapered lags, which are segments of a cylinder, may be field cut as discussed in this report or may be furnished precut by the cork insulation manufacturer.

Cork is an easily worked material and is rigid enough to be cut, shaped, and applied to pipe, fittings, and unsymmetrical items. Cork is flammable but much less so than some synthetic insulation materials. It will burn with a smoldering fire but requires intensive heat and flame to keep it burning.

Any insulation, no matter what the material, is no better than the installation. A good job of the initial installation is well worth the effort.

Select Correct Thickness for Service

Several papers have been published which deal with the economical thickness of insulation. Formulas and tables have been developed. It is not the purpose of this report to discuss these; however, one should be sure that these are correctly applied for curved surfaces. For complete engineering information on the various types of insulation, it is suggested that manufacturers data be consulted.

Table 1 shows the comparative heat losses for pipe sizes from ¼ to 20 in. with three commercially available thicknesses of cork covering. The use of this table simplifies the calculation of refrigeration savings with insulated cork covered lines. The following example will illustrate its use.

Assume a 2 in. pipe line 100 ft long is to carry 10 F brine with surrounding air at 80 F. The temperature difference is 70 F deg. The heat loss per lineal ft of bare 2 in. pipe is 1.38 Btu per hr per F deg difference in temperature. The total annual loss is 1.38 × 8,760 hr × 70 F deg × 100 ft = 84,621,000 Btu's and dividing by 288,000 (Btu's per ton-day) = 293.8 ton-days. Assuming standard duty thickness cork insulation is to be used, the annual refrigeration loss for the same operating conditions is 0.131 × 8,760 × 70 × 100 = 8,032,900 Btu's and dividing by 288,000 = 27.9 ton-days.

The annual saving with insulation is then 293.8 −27.9 or 265.9 ton-days. Assuming refrigeration costs $1.50 per ton-day, the annual saving is $400. If the installed cost of 100 lin ft of standard duty cork insulation is $300, the investment would pay for itself in 9 months.

This same reasoning can be used to justify one insulation thickness over a thinner layer in cases where the operating temperature is at the break point between one thickness and the next thicker. Normally, light duty thickness cork is recommended for temperatures above 35 F, standard duty thickness for 0 F to 35 F, and heavy duty thickness for service from 0 to −35 F. For economical reasons, it is usually best to use the commercially available thickness for the temperature range in which the intended service falls.

Table 2 may be used as a guide in choosing the type and thickness of cork insulation for pipe and fittings from cold water temperature down to −100 F. The size or curvature of the vessel or pipe affects the insulation thickness for any given temperature. Economic studies of a specific installation may vary from this guide especially at the very low temperatures. However, with a large installation including numerous pipe sizes, it is usually best economically to limit the variation in cork thicknesses to a few in order to use those commercially available. Special thicknesses usually cost more than they are worth.

TABLE 1 — HEAT TRANSMISSION LOSS per foot of pipe with various thicknesses of cork insulation is given here

Pipe size, in.	Transmission loss*, Btu per lin ft per hr per F deg			
	Bare pipe	Light duty thickness	Standard duty thickness	Heavy duty thickness
¼	0.45	0.080	0.071	0.061
⅜	0.49	0.091	0.098	0.067
½	0.57	0.104	0.090	0.074
¾	0.67	0.111	0.097	0.083
1	0.82	0.121	0.105	0.087
1¼	1.01	0.135	0.110	0.959
1½	1.13	0.155	0.116	0.104
2	1.38	0.175	0.131	0.113
2½	1.65	0.207	0.145	0.132
3	1.95	0.215	0.157	0.147
3½	2.20	0.236	0.167	0.146
4	2.44	0.254	0.192	0.163
5	2.97	0.300	0.211	0.173
6	3.50	0.326	0.238	0.187
8	4.45	0.400	0.276	0.227
10	5.48	0.457	0.329	0.268
12	6.48	0.658	0.377	0.303
14	7.09	0.712	0.415	0.327
16	8.15	0.819	0.462	0.363
18	9.11	0.867	0.509	0.405
20	10.10	0.972	0.553	0.438

*Data from Armstrong Cork Co., 1947.

Lagged or Molded Coverings

Molded cork covering is preformed in 36 in. lengths at predetermined thicknesses to fit all pipe sizes up to 12 or 14 in. OD depending on the insulation thickness. Beyond this size, the insulation is of uniform thickness for a given duty and is available in lag form or in sheets to be cut into lags.

In some plants or construction sites, it may be found to be more economical to cut the lags on the job for pipe sizes even smaller than the size where the molded sections are available. On a large job, if molded cork is contemplated, storage space, and handling with possible breakage especially of molded valve covers, may be critical items. Flat sheets 12 in. × 36 in. are easily stacked in storage. For normal maintenance, it is often best to stock sheet material which can be cut into lags for the pipe size required. If molded sections

TABLE 2 — INSULATION SCHEDULE for pipe, valves, and fittings up to 24 in. pipe size is presented here

Service	Insulation for	Size of pipe and fittings, in.	Type and form of insulation	Size of material	Surface finish
Ordinary cold water	Pipe	All sizes	Anti-sweat	1 in. thick, 36 in. long	Portland asbestos cement
	Valves and fittings	All sizes	Hair felt wrapping	1 in. thick	
Chilled water	Pipe	12 and under	Light duty cork, molded sectional	36 in. long	Seam filler and vapor seal
		14 to 24	Light duty cork lags	36 in. long	
	Valves and fittings	3 and under	Light duty molded cork covers	As required	
		4 to 24	Light duty cork lags	As required	
0 F to 35 F	Pipe	14 and under	Standard duty cork, molded sectional	36 in. long	Seam filler and vapor seal
		16 to 24	Standard duty cork lags	36 in. long	
	Valves and fittings	3 and under	Standard duty cork, molded covers	As required	
		4 to 24	Standard duty cork lags	As required	
0 F to −35 F	Pipe	12 and under	Heavy duty cork, molded sectional	36 in. long	Seam filler and vapor seal
		14 to 24	Heavy duty cork lags	36 in. long	
	Valves and fittings	4 and under	Heavy duty cork, molded covers	As required	
		5 to 24	Heavy duty cork lags	As required	
−35 F to −50 F	Pipe	4 and under	4 in. thick cork, molded sectional	36 in. long	Thick vapor seal
		5 to 24	5 in. thick cork lags	36 in. long	
	Valves and fittings	2 and under	4 in. thick cork, molded sectional	As required	
		2½ to 24	5 in. thick cork lags	36 in. long	
−50 F to −100 F	Pipe	3 and under	5 in. thick cork, molded sectional	36 in. long	Thick vapor seal
		3½ to 8	6 in. thick cork lags	36 in. long	
		10 to 24	7 in. thick cork lags	36 in. long	
	Valves and fittings	2 and under	5 in. thick cork, molded sectional	As required	
		2½ to 6	6 in. thick cork lags	As required	
		8 to 24	7 in. thick cork lags	As required	
Below −100 F	Very special and infrequent service, insulation thickness may vary from 4 in. up to 16 in. depending on temperature differential and pipe and vessel size				

TABLE 3 — CORK THICKNESS AND WEIGHT, and lag schedule for pipe in sizes from 8 to 24 in. are listed below

Nominal pipe size, in.	OD of Pipe, in.	Thickness of insulation, in.				OD of insulation, in.				Net weight of insulation, lb per lin ft				Sheets required for lags per 3 ft of pipe*		
		Anti-sweat	Light duty	Standard duty	Heavy duty	Anti-sweat	Light duty	Standard duty	Heavy duty	Anti-sweat	Light duty	Standard duty	Heavy duty	1½ in. thick	3 in. thick	4 in. thick
¼	0.540		1.35	1.85	2.88		3.25	4.25	6.31		1.00	1.31	2.06			
⅜	0.675		1.28	1.78	2.82		3.25	4.25	6.31		0.75	1.25	2.44			
½	0.840	1.0	1.20	1.70	2.73	2.84	3.25	4.25	6.31	1.25	0.70	1.25	2.19			
¾	1.050	1.0	1.35	1.82	2.63	3.05	3.75	4.69	6.31	1.39	1.00	1.38	2.19			
1	1.315	1.0	1.47	2.00	2.97	3.32	4.25	5.31	7.25	1.57	1.25	1.63	3.31			
1¼	1.660	1.0	1.51	2.32	3.10	3.66	4.69	6.31	7.87	1.83	1.44	2.06	3.63			
1½	1.900	1.0	1.39	2.42	2.99	3.90	4.69	6.75	7.87	1.87	1.31	2.38	3.31			
2	2.375	1.0	1.47	2.44	3.25	4.38	5.31	7.25	8.87	2.36	1.63	2.68	4.69			
2½	2.875	1.0	1.37	2.50	3.00	4.88	5.62	7.87	8.87	2.78	1.69	3.00	4.00			
3	3.500	1.0	1.56	2.68	3.06	5.50	6.75	8.87	9.62	3.14	2.19	4.00	4.44			
3½	4.000	1.0	1.62	2.81	3.56	6.00	7.25	9.62	11.12	3.46	2.38	4.38	6.00			
4	4.500	1.0	1.68	2.56	3.31	6.50	7.87	9.62	11.12	3.78	2.38	4.12	5.81			
5	5.563	1.0	1.65	2.78	3.78	7.56	8.87	11.12	13.12	4.33	3.30	5.38	7.69			
6	6.625	1.0	1.81	2.78	4.00	8.63	10.25	12.19	14.62	5.00	3.75	6.00	8.12			
8	8.625	1.0	1.78	3.00	3.81	10.63	12.19	14.62	16.25	6.29	4.31	7.25	11.75			4
10	10.750	1.0	1.93	3.31	4.19	12.75	14.62	17.37	19.12	7.60	5.75	10.85	14.44		4 1/3	4 2/3
12	12.750	1.0	1.75	3.18	4.12	14.75	16.25	19.12	21.00	8.88	6.96	11.93	14.94	4 1/3	4 2/3	5
14	14.000		1.50	3.00	4.00		17.00	20.00	22.00		6.50	12.15	15.54	4 2/3	5 1/3	5 2/3
16	16.000		1.50	3.00	4.00		19.00	22.00	24.00		7.20	13.49	17.18	5 1/3	5 2/3	6
18	18.000		1.50	3.00	4.00		21.00	24.00	26.00		7.92	14.42	18.67	6	6 1/3	6 2/3
20	20.000		1.50	3.00	4.00		23.00	26.00	28.00		8.56	15.70	20.43	6 1/3	7	7 1/3
24	24.000		1.50	3.00	4.00		27.00	30.00	32.00		9.80	18.37	23.55	7 2/3	8	8 1/3

*2 additional sheets required for each fitting or valve.

were stocked for all pipe sizes up to 12 or 14 in. more storage space would be required.

The necessary tools to cut lags from the sheet, are rather simple. These include a bench saw with a tilting table for cutting the lags and a band saw for cutting deep sections such as beveling cork assemblies, splitting sheets, etc. In addition to these tools, it is essential to have available dummy lags of wood which are accurately made for the pipe size and cork thickness. These dummy lags are used to make the final setting of the table angle of the bench saw.

Cork in all thicknesses is available in sheets 12 in. wide by 36 in. long. For wall insulation, the cork is usually uncoated and a little less dense than that intended for lagging. Cork for lags should be specified as lag quality cork painted with a light coat of asphalt on both sides. The light coat of paint helps to hold the corners intact while the lags are being cut. Uncoated sheet cork, intended for wall or other flat installation, when cut into lags tends to crumble at the corners. An exception to using lag quality cork painted is when it is to be applied to a large tank or other vessel and the outside surface is to be heavily coated with a vapor seal. In this case, plain cork is best since the rough surface provides a good bond for the exterior coat.

TABLE 4 — DATA for determining operating loads on pipe lines for hanger design are listed here

Nominal pipe size, in.	Weight of pipe, lb per lin ft	Weight of water per ft of pipe, lb	Weight of brine[a] per ft of pipe, lb	Ice load, lb per lin ft			
				Anti-sweat	Light duty	Standard duty	Heavy duty
¼	0.424	0.045	0.059		5.8	7.1	10.0
⅜	0.567	0.083	0.108		5.8	7.1	10.0
½	0.850	0.132	0.171	5.2	5.8	7.1	10.0
¾	1.130	0.230	0.299	5.5	6.5	7.8	10.0
1	1.678	0.374	0.486	5.9	7.1	8.6	11.2
1¼	2.272	0.647	0.840	6.3	7.8	10.0	12.0
1½	2.717	0.882	1.140	6.8	7.8	10.6	12.0
2	3.652	1.450	1.890	7.3	8.6	11.2	13.4
2½	5.790	2.070	2.690	8.0	9.0	12.0	13.4
3	7.570	3.200	4.160	8.9	10.6	13.4	14.5
3½	9.110	4.280	5.560	9.5	11.2	14.5	16.5
4	10.790	5.510	7.160	10.2	12.1	14.5	16.5
5	14.620	8.660	11.250	11.6	13.4	16.5	19.3
6	18.970	12.510	16.260	13.1	15.3	17.9	21.3
8	28.550	21.600	28.100	15.8	17.9	21.3	23.4
10	40.480	34.100	44.300	18.7	21.3	25.0	27.3
12	49.000	48.900	63.400	21.4	23.4	27.3	30.0
14	54.000	58.700	76.200		24.5	30.0	31.3
16	62.000	79.100	102.800		27.2	32.7	34.0
18	71.000	101.200	131.600		30.0	35.4	36.9
20	79.000	126.000	163.800		32.7	38.1	39.5
24	95.000	183.800	238.900		38.1	43.5	45.0

[a] Assumed brine density of 81 lb per cu ft.

TABLE 5 — QUANTITY AND TYPE of fastening for cork covered pipe lines are given here

Nominal pipe size, in.	Type of fastening[a]	Quantity of wire or band per ft of pipe, lin ft			
		Anti-sweat[b]	Light duty	Standard duty	Heavy duty
¼	14 ga wire		3.62	4.30	5.75
⅜			3.62	4.30	5.75
½		2.49	3.62	4.30	5.75
¾		2.60	3.96	4.60	5.75
1		2.73	4.30	5.04	6.30
1¼		2.92	4.60	5.75	6.81
1½		3.08	4.60	6.05	6.81
2		3.28	5.04	6.30	7.54
2½		3.55	5.25	6.81	7.54
3	12 ga wire	3.88	6.05	7.54	7.85
3½		4.15	6.30	7.85	9.10
4		4.40	6.81	7.85	9.10
5	½ in. band	2.48	7.54	9.10	10.50
6		2.76	8.55	9.87	11.62
8		3.28	9.87	11.62	12.68
10		3.83	11.62	13.40	14.65
12		4.36	12.68	14.65	16.20
14	¾ in. band		13.25	16.20	16.70
16			14.58	17.35	18.05
18			16.20	18.72	19.50
20			17.35	20.16	20.80
24			20.16	22.82	23.60

[a] Fastening for valves and fittings: ten percent more bands or wire are required than amount for an equivalent length of pipe. When wire is required use 10 ga.

Fastening when roofing is used to cover outdoor lines: an additional amount equal to one half that required for the insulation.

For roll roofing on outdoor lines, bands should be used on 9 in. centers.

In the above table where wire is indicated, copper coated steel is recommended. Where bands are indicated, galvanized steel may be used for normal locations. In areas where excessive moisture or corrosive atmospheres may be present stainless steel bands in the sizes indicated are recommended. In all cases two galvanized or stainless steel band clips should be used per band.

Wires for anti-sweat insulation should be on 12 in. centers. Wire and bands for cork should be on 4½ in. centers.

[b] Anti-sweat insulation is furnished with canvas scrim and requires no wires or bands for fastening to pipe. Thus, these figures represent the wire or bands required only if covered with roofing.

How Much Insulation, What Accessories Required?

Table 3 is a schedule showing for all pipe sizes up to 24 in., the insulation thickness for the three service duties, insulation outside diameters, weight of insulation and the number of 12 in. × 36 in. sheets of cork required for lags to make one course on pipe sizes 8 in. and larger. This table is useful in determining clearance between covered lines and other objects and in determining quantities of sheet cork for a given job.

Table 4 is used with Table 3 in determining operating pipe loads for hanger selection. For hanger design, the weights of pipe, insulation, and fluid inside the pipe, and the ice load are added together for a given pipe size and multiplied by the proposed span length. This result is the total weight to be supported by the hanger. The column in the table showing weight of brine per foot of pipe is calculated for calcium chloride brine with a specific gravity of 1.30 at the operating temperature. The weights are on the safe side for any calcium chloride brine system.

The ice load is used in calculating the total pipe load for span loading on *outside lines only* and is intended as a safety factor. It insures against the possibility of overload due to ice and snow building up on the lines during freezing weather. The use of these weights is optional depending on conditions, and may be safely omitted in warm climates.

The quantities and types of fastening required for holding cork covering are given in Table 5. Quantities of wire or bands are given in feet per foot of pipe.

The quantity of roofing felt required for covering outdoor lines is given in Table 6. These quantities are also given per foot of pipe.

The other accessories required to install cork are the adhesive, seam filler, and the vapor seal. These items presented in Table 7 are to be used as a guide in figuring quantities. The amounts given are liberal but actual quantities may vary depending upon how heavily the materials are applied.

Apparent discrepancies in Table 7 such as the equal quantities and the lesser quantities shown as required for 3½ to 4 in., etc., are due to the actual dimensions of the commercially available covers as indicated by Table 3. Table 7 is set up with the assumption that lag covers are used starting with the 8 in. and 10 in. pipe sizes rather than 12 in. and 14 in. where commercially available molded covers cease. In the region of 8 to 14 in. pipe sizes, materials required for either molded or lag covers can be interpolated from the table.

The adhesive cement listed in Table 7 is that used for cementing all joints. The cement should be moistureproof and unaffected by brine, ammonia fumes, or any other material that might come in contact with the cork. The cement used also should not be harmful to any chemicals being produced in the area.

The seam filler is used for filling chipped edges, making smooth surfaces at the seams of the cork molded covers or lags, and for filling to a smooth surface the voids in the raw surface of cut cork such as at valve bonnets, etc.

The vapor seal material may be a brushed-on paint and Table 7 is set up on this basis. The sealer must be moistureproof above all and also not contaminate the products in the area. Emulsified asphalt paint has been used successfully on large quantities of cork covered lines carrying brine at low temperatures. Also, several good sealers are available from insulation suppliers which should not be overlooked. On large tanks or wherever a heavy coat is required, the sealer may be mixed with short fiber asbestos to give a trowelling mixture or commercially available mixtures may be obtained and trowelled on.

TABLE 6 — QUANTITY OF ROOFING FELT required to cover outdoor lines is listed here

Nominal pipe size, in.	Two ply roofing felt needed per ft of pipe,[a] sq ft			
	Anti-sweat	Light duty	Standard duty	Heavy duty
¼		0.77	1.06	1.67
⅜		0.77	1.06	1.67
½	1.20	0.77	1.06	1.67
¾	1.26	0.92	1.19	1.67
1	1.34	1.06	1.38	1.95
1¼	1.44	1.19	1.67	2.13
1½	1.54	1.19	1.80	2.13
2	1.65	1.38	1.95	2.43
2½	1.80	1.47	2.13	2.43
3	1.98	1.80	2.43	2.63
3½	2.13	1.95	2.63	3.09
4	2.28	2.13	2.63	3.09
5	2.59	2.43	3.09	3.68
6	2.90	2.83	3.41	4.12
8	3.49	3.41	4.12	4.60
10	4.11	4.12	4.93	5.45
12	4.71	4.60	5.45	6.00
14		4.83	6.00	6.30
16		5.41	6.59	6.89
18		6.00	7.18	7.47
20		6.59	7.77	8.06
24		7.77	8.95	9.25

[a] Quantity of roofing felt provides a 2 in. maximum gap at bottom and a 4 in. lap around the pipe on horizontal lines. For roofing felt on vertical lines and for cases where print cloth is required add ½ sq ft per ft of pipe to these quantities so as to provide a 4 in. circumferential and a 4 in. longitudinal lap.

TABLE 7 — PAINT AND CEMENT required per 100 ft of cork covered lines is given here

Pipe size, in.	Light duty cork			Standard duty cork			Heavy duty cork		
	Adhesive cement, gal	Seam filler, gal	Vapor seal, gal	Adhesive cement, gal	Seam filler, gal	Vapor seal, gal	Adhesive cement, gal	Seam filler, gal	Vapor seal, gal
¼*	0.63	0.43	0.47	0.87	0.45	0.62	1.42	0.51	0.92
⅜*	0.60	0.43	0.47	0.85	0.45	0.62	1.39	0.51	0.92
½*	0.56	0.43	0.47	0.81	0.45	0.62	1.36	0.51	0.92
¾*	0.64	0.44	0.55	0.89	0.47	0.69	1.31	0.51	0.92
1 *	0.71	0.45	0.62	0.98	0.49	0.77	1.51	0.55	1.06
1¼*	0.72	0.47	0.69	1.17	0.51	0.92	1.61	0.56	1.15
1½*	0.69	0.47	0.69	1.28	0.53	1.00	1.54	0.56	1.15
2 *	0.73	0.49	0.77	1.26	0.55	1.06	1.73	0.60	1.29
2½*	0.70	0.50	0.82	1.32	0.56	1.15	1.62	0.60	1.29
3 *	0.82	0.52	0.96	1.46	0.60	1.29	1.69	0.63	1.40
3½*	0.87	0.54	1.06	1.56	0.63	1.40	2.03	0.65	1.62
4 *	0.92	0.56	1.15	1.44	0.63	1.40	1.90	0.65	1.62
5 *	0.93	0.60	1.29	1.63	0.65	1.62	2.28	0.71	1.91
6 *	1.06	0.63	1.49	1.68	0.69	1.77	2.51	0.75	2.13
8 *†	1.11	0.69	1.77	1.87	0.75	2.13	21.71	0.81	2.45
10 *†	1.29	0.75	2.13	17.62	0.81	2.50	25.26	0.87	2.78
12 †	8.83	0.78	2.33	19.01	0.87	2.79	27.12	0.93	3.06
14 †	9.50	0.82	2.52	21.63	0.93	2.94	30.63	0.99	3.24
16 †	10.83	0.88	2.82	23.03	0.99	3.24	32.48	1.05	3.49
18 †	12.17	0.94	3.07	25.70	1.05	3.51	36.05	1.10	3.80
20 †	12.86	1.02	3.36	28.38	1.10	3.80	39.61	1.16	4.09

*Molded sectional covering.

†Lagged covering. Note increased quantity of adhesive for cementing lags.

Determine Lag Widths to Insure Good Fit

In order to cut lags most economically from the 12 in. wide sheets, tables of lag dimensions were calculated for cork thicknesses from 1½ to 6 in. The first consideration in developing the necessary formulas was to provide a lag narrow enough to make a minimum void against the pipe but wide enough to insure sufficient strength to withstand normal handling without excessive breakage. Also considered was the amount of waste due to the saw cuts required. This study resulted in a minimum average thickness of the tapering lag of about 1½ in. on the smallest pipe sizes calculated. This thickness was made larger for larger pipe diameters which have less curvature causing less voids. On this basis, the number of lags to be cut from a 12 in. sheet for pipe up to 36 in. was determined to be six, for pipe from 38 to 50 in. the number of lags per sheet was reduced to four, and for pipe or tanks larger than 50 in. diam three lags are cut from a sheet. As a flat surface is approached, the whole sheet becomes the lag.

TABLE 8 — LIGHT DUTY (1½ in.) cork covering lagging schedule for pipe is listed below

OD pipe size, in.	OD of cork, in.	Number of lags per course	Width of lag, in.		Number of lags from 12 × 36 in. sheet	Sheets per 3 ft of pipe
			Top	Bottom		
12.75	15.75	26	1 29/32	1 17/32	6	4 1/3
14.00	17.00	28	1 29/32	1 37/64	6	4 2/3
16.00	19.00	32	1 7/8	1 37/64	6	5 1/3
18.00	21.00	36	1 27/32	1 37/64	6	6
20.00	23.00	38	1 29/32	1 21/32	6	6 1/3
24.00	27.00	46	1 27/32	1 21/32	6	7 2/3
26.00	29.00	50	1 13/16	1 5/8	6	8 1/3
28.00	31.00	52	1 7/8	1 11/16	6	8 2/3
30.00	33.00	56	1 21/32	1 11/16	6	9 1/3
32.00	35.00	60	1 27/32	1 11/16	6	10
34.00	37.00	64	1 13/16	1 21/32	6	10 2/3
36.00	39.00	44	2 25/32	2 9/16	4	11
38.00	41.00	46	2 13/16	2 19/32	4	11 1/2
40.00	43.00	48	2 13/16	2 5/8	4	12
42.00	45.00	50	2 27/32	2 21/32	4	12 1/2
44.00	47.00	52	2 27/32	2 21/32	4	13
46.00	49.00	54	2 27/32	2 11/16	4	13 1/2
48.00	51.00	58	2 3/4	2 19/32	4	14

From the formulas derived, Tables 8 to 13 were calculated. These tables give the lag dimensions and the number of 12 in. × 36 in. sheets required per course or per 3 ft of pipe, together with other pertinent data. It will be noted that the starting pipe size in each table is smaller for each greater cork thickness. Reference to the thickness schedule in Table 2, page 141, shows the approximate break point between molded covering and lagged covering.

To check lag dimensions for a perfect fit, the cork shop should have wooden lags for all of the usual pipe sizes and cork thicknesses. These should be accurately made and used to assist in setting up the saw cut angle and the fence distance from the saw.

TABLE 9 — TWO IN. CORK covering lagging schedule for pipe is given here

OD pipe size, in.	OD of cork, in.	Number of lags per course	Width of lag, in.		Number of lags from 12 × 36 in. sheet	Sheets per 3 ft of pipe
			Top	Bottom		
16	20	32	1 31/32	1 37/64	6	5 1/3
18	21	36	1 59/64	1 37/64	6	6
20	24	40	1 57/64	1 37/64	6	6 2/3
24	28	46	1 29/32	1 41/64	6	7 2/3
26	30	50	1 57/64	1 41/64	6	8 1/3
28	32	54	1 55/64	1 5/8	6	9
30	34	58	1 27/32	1 5/8	6	9 2/3
32	36	60	1 7/8	1 11/16	6	10
34	38	64	1 7/8	1 21/32	6	10 2/3
36	40	44	2 7/8	2 9/16	4	11
38	42	46	2 7/8	2 19/32	4	11 1/2
40	44	48	2 7/8	2 5/8	4	12
42	46	50	2 57/64	2 41/64	4	12 1/2
44	48	54	2 51/64	2 9/16	4	13 1/2
46	50	56	2 13/16	2 19/32	4	14
48	52	58	2 13/16	2 19/32	4	14 1/2
45*	49	56	2 3/4	2 17/32	4	14
51*	55	64	2 11/16	2 1/2	4	16
66*	70	58	3 51/64	3 37/64	3	19 1/3
72*	76	62	3 27/32	3 21/32	3	20 2/3
76*	80	66	3 13/16	3 5/8	3	22

*Tank size.

When the saw is set, one course of lags should be cut and set up on the shop floor without adhesive and drawn tightly together with wire around a pipe the same size as that to be covered. The assembly should be checked for accurate fit to the pipe and to each other. On very large pipe sizes such as 18 in. or larger, the lags may be assembled without a pipe specimen and the inside diameter of the cork cylinder measured. Any inaccuracies that cannot be corrected by tightening the lags together should be corrected by small adjustments to the saw. With accurate workmanship a second saw adjustment is rarely necessary. However, the test assembly is recommended for every saw setting. This is a vital procedure to insure a good installation job.

How Formulas for Determining Lag Dimensions Were Derived

The general formula for determining the number and size of lags on pipe and tanks to give the most economical use of 12 in. wide lag quality cork board is as follows:

$$12 \text{ in.} \geqq [(n/2)\ (a)] + [(n/2)\ (b)] + (0.15625)\ (n + 1) + [(a - b)/2] \tag{1}$$

where as shown in the figure:

a = width of lag at top, in.
b = width of lag at bottom, in.
n = number of lags per 12 in. × 36 in. sheet
N = number of lags per course on pipe
d = outside diameter of pipe or tank, in.
d' = outside diameter of cork covering, in.

If $n = 6$ (which, for pipe up to 36 in. OD, provides small voids adjacent to pipe and makes lag large enough for ease of handling without breakage), then:

$$12 \geqq 3a + 3b + (7)\ (0.15625) + [(a - b)/2]$$
$$12 \geqq 3a + 3b + 1.09375 + 0.5a - 0.5b$$
$$10.906 = 3.5a + 2.5b \tag{2}$$

Also:

$$a = \pi d'/N \tag{3}$$
$$b = \pi d/N \tag{4}$$

Substituting (3) and (4) in (2)

$$10.906 = (3.5\pi d' + 2.5\pi d)/N$$
$$10.906 = (10.995d' + 7.854d)/N$$
$$N = (10.995d' + 7.854d)/10.906$$

which reduces to:

$$N = (1.40d' + d)/1.389 \tag{5}$$

It should be noted that N must be rounded up to the next larger *even* number so that the lag ends can be staggered along the pipe.

For pipes from 36 in. OD to 50 in. OD use $n = 4$. Substituting in equations (1), (3), and (4) and reducing, the solution is as follows:

$$N = (1.666d' + d)/2.381 \tag{6}$$

For tanks 50 in. OD and larger use $n = 3$. Substituting in the general equations, the solution is as follows:

$$N = (2d' + d)/3.620 \tag{7}$$

The following example will serve to illustrate the use of these formulas for determining lag dimensions.

Example:

Find the number and size of lags to cover a 24 in. OD pipe with 2 in. thick cork.

$$d = 24 \text{ in. and } d' = 28 \text{ in.}$$

$$\begin{aligned} N &= [(1.4)\ (28) + 24]/1.389 \\ &= 45.5 \quad \text{(use 46 lags per course)} \end{aligned}$$

then by equations (3) and (4):

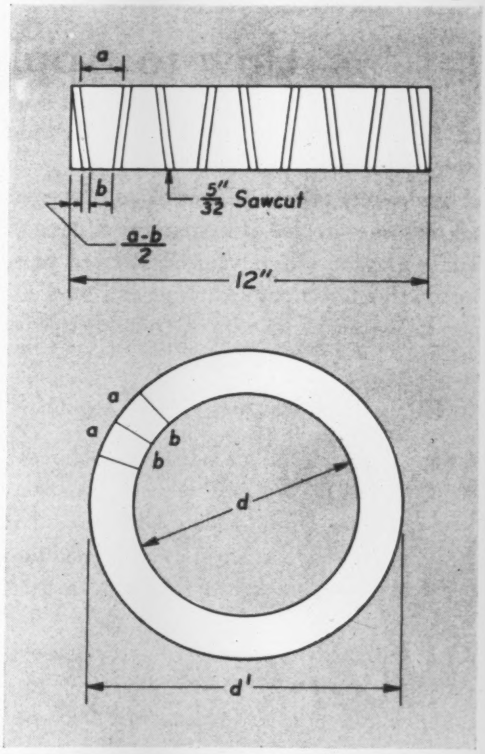
$$a = [(3.1416)\ (28)]/46 = 1.915 \text{ in.}$$
$$b = [(3.1416)\ (24)]/46 = 1.640 \text{ in.}$$

check results by equation (1):

$$\begin{aligned} 3 \times 1.915 &= 5.745 \text{ in.} \\ 3 \times 1.640 &= 4.920 \text{ in.} \\ (7)\ (0.15625 \text{ sawcuts}) &= 1.094 \text{ in.} \\ (1.915 - 1.640)/2 &= \underline{\ \ .138 \text{ in.}} \\ &\ \ \ 11.897 \text{ in.} \end{aligned}$$

Since the total above is less than 12 in., the calculated number of lags per course and the lag dimensions are acceptable.

These same formulas can be used to determine number and size of lags for any tank diameter. Proper values of n must be substituted to insure good fit and adequate lag size for ease of handling.



LAG DIMENSIONS shown here were used to derive formulas

TABLE 10 — STANDARD DUTY (3 in.) cork covering lagging schedule for pipe is listed here

OD pipe size, in.	OD of cork, in.	Number of lags per course	Width of lag, in.		Number of lags from 12 × 36 in. sheet	Sheets per 3 ft of pipe
			Top	Bottom		
8.625	14.625	22	2 3/32	1 15/64	6	4
10.750	16.750	26	2 1/32	1 19/64	6	4 1/3
12.750	18.750	28	2 7/64	1 7/16	6	4 2/3
14.000	20.000	32	1 31/32	1 3/8	6	5 1/3
16.000	22.000	34	2 1/32	1 31/64	6	5 2/3
18.000	24.000	38	1 63/64	1 31/64	6	6 1/3
20.000	26.000	42	1 61/64	1 1/2	6	7
24.000	30.000	48	1 31/32	1 37/64	6	8
26.000	32.000	52	1 15/16	1 9/16	6	8 2/3
28.000	34.000	56	1 29/32	1 37/64	6	9 1/3
30.000	36.000	60	1 57/64	1 9/16	6	10
32.000	38.000	64	1 7/8	1 37/64	6	10 2/3
34.000	40.000	66	1 29/32	1 5/8	6	11
36.000	42.000	46	2 7/8	2 15/32	4	11 1/2
38.000	44.000	48	2 7/8	2 31/64	4	12
40.000	46.000	50	2 57/64	2 33/64	4	12 1/2
42.000	48.000	52	2 29/32	2 17/32	4	13
44.000	50.000	54	2 29/32	2 9/16	4	13 1/2
46.000	52.000	56	2 59/64	2 37/64	4	14
48.000	54.000	58	2 15/16	2 39/64	4	14 1/2
60.000*	66.000	54	3 27/32	3 1/2	3	18
68.000*	74.000	64	3 5/8	3 21/64	3	21 1/3

*Tank size.

TABLE 11 — HEAVY DUTY (4 in.) cork covering lagging schedule for pipe is given here

OD pipe size, in.	OD of cork, in.	Number of lags per course	Width of lag, in.		Number of lags from 12 × 36 in. sheet	Sheets per 3 ft of pipe
			Top	Bottom		
5.563	13.56	24	1 25/32	23/32	8	3
6.625	14.62	26	1 49/64	51/64	8	3 1/4
8.625	16.62	24	2 3/16	1 1/8	6	4
10.750	18.75	28	2 7/64	1 13/64	6	4 2/3
12.750	20.75	30	2 11/64	1 11/32	6	5
14.000	22.00	34	2 1/32	1 19/64	6	5 2/3
16.000	24.00	36	2 3/32	1 25/64	6	6
18.000	26.00	40	2 3/64	1 13/32	6	6 2/3
20.000	28.00	44	2	1 7/16	6	7 1/3
24.000	32.00	50	2 1/64	1 33/64	6	8 1/3
26.000	34.00	54	1 31/32	1 1/2	6	9
28.000	36.00	58	1 15/16	1 17/32	6	9 2/3
30.000	38.00	62	1 15/16	1 17/32	6	10 1/3
32.000	40.00	64	1 31/32	1 9/16	6	10 2/3
34.000	42.00	68	1 15/16	1 9/16	6	11 1/3
36.000	44.00	48	2 7/8	2 5/8	4	12
38.000	46.00	50	2 29/32	2 5/8	4	12 1/2
40.000	48.00	52	2 29/32	2 13/32	4	13
42.000	50.00	54	2 29/32	2 7/16	4	13 1/2
44.000	52.00	56	2 29/32	2 15/32	4	14
46.000	54.00	58	2 15/16	2 1/2	4	14 1/2
48.000	56.00	60	2 15/16	2 17/32	4	15
60.500*	68.50	56	3 7/8	3 13/32	3	18 2/3
68.500*	76.50	64	3 3/4	3 23/64	3	21 1/3
69.000*	77.00	66	3 21/32	3 9/32	3	22
94.000*	102.00	82	3 59/64	3 11/16	3	27 1/3

*Tank size.

TABLE 12 — SIX IN. CORK covering lagging schedule for pipe is given here

OD pipe size, in.	OD of cork, in.	Number of lags per course	Width of lag, in.		Number of lags from 12 × 36 in. sheet	Sheets per 3 ft of pipe
			Top	Bottom		
4.500	16.500	26	2	35/64	8	3 1/4
6.625	18.625	24	2 7/16	7/8	6	4
8.625	20.625	28	2 5/16	31/32	6	4 2/3
10.750	22.750	32	2 15/64	1 3/64	6	5 1/3
12.750	24.750	36	2 5/32	1 7/64	6	6
14.000	26.000	38	2 5/32	1 5/32	6	6 1/3
16.000	28.000	40	2 13/64	1 1/4	6	6 2/3
18.000	30.000	42	2 1/4	1 11/32	6	7
20.000	32.000	48	2 3/32	1 5/16	6	8
24.000	36.000	54	2 3/32	1 25/64	6	9

TABLE 13 — EIGHT IN. CORK covering lagging schedule for tanks given here

OD tank size, in.	OD of cork, in.	Number of lags per course	Width of lag, in.		Number of lags from 12 × 36 in. sheet	Sheets per 3 ft of pipe
			Top	Bottom		
63	79	62	4.01	3.19	3	20 2/3
120	136	108	3.95	3.50	3	36

How to Apply Lags to Piping

Prior to the application of an insulation on black steel pipe, the pipe should be painted with a good oxide steel primer. This will help prevent external corrosion in case of insulation failure and moisture migration. On galvanized screwed pipe, the threads should be painted. Iron and steel fittings, bolts, and nuts should also be painted.

Cover Pipe on Ground When Possible

Covering pipe on the ground, especially the larger sizes where lags are used, reduces labor costs and does not increase the hoisting labor over that for bare pipe. A ground level insulation operation will better insure a good fitting job and a thorough vapor sealing since the pipe can be rotated and all surfaces easily worked upon and inspected. After erection when the pipe is joined together by welding or flanges, as the case may be, and pressure tests are completed, the bare pipe joint insulation is installed tightly with the ends cemented to the cork already in place.

On a pipe insulation job, installed a few years ago, 400 ft of 18 in. pipe, 3000 ft of 16 in., 1200 ft of 14 in., 1700 ft of 12 in., and several thousand feet of 4, 3, and 2 in. designed to carry a fluid at −100 F were covered with 6 in. thick cork. A large amount of this pipe was out of doors. On this job all possible outdoor pipe was painted and then covered on the ground. (See Fig. 1) This included vapor sealing, applying roll roofing for weather protection, and strapping on the hanger or support saddles. Wood slat slings were used around the cork when hoisting the line into position overhead.

One-third of this job was covered with cork lags made up into preassembled half cylinders. (See Fig. 2) It was at first thought that making up the cylinders beforehand would cut the labor cost of installation. This did not prove to be the case because it was found that difficulty was experienced in getting the adjacent cylinder edges to butt evenly and tightly against each other. This difficulty with some cylinders was caused by unequal lengths of the lags which were found to vary as much as 1/8 in. in a 3 ft lag. The remaining portion of the insulation was installed by the old and proven method of staggering the lags around the pipe. With this method the slightly unequal lengths became insignificant.

Use Staggered Joint Construction

For a more homogeneous construction and one that will not develop separations between the lag ends, the lags are best installed with staggered joint construction. That is, alternate lags of 9 in. and 27 in. lengths are applied, starting at a flange, to make the first course around the pipe. (See Fig. 3) Then as each succeeding course is applied, using the full 36 in. length lag with each end pushed tightly against its neighbor, a staggered or broken joint assembly is attained with the joints at the midpoint of the adjacent lag.

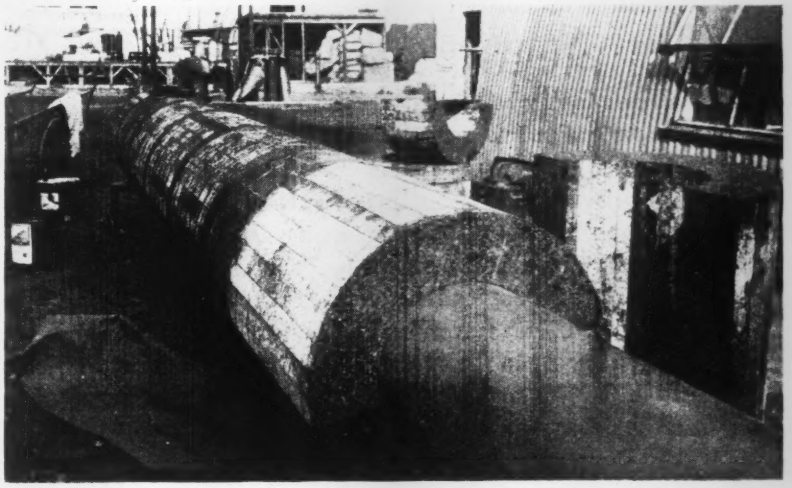
To support the lags in place while being installed, a heavy sash cord or a strap with a coil spring placed around the pipe or fitting is very handy to use. The lags are slipped into place under the strap one at a time.

Adhesive cement is applied only to the lag being installed at the moment and only to the cut surfaces of this lag which will come in contact with the adjoining surfaces of the lags already in place. That is, only half the length of each lag is coated with cement on each side and one end as it as being installed. In this way excessive cement is not used and only one coat of cement is applied between the lags.

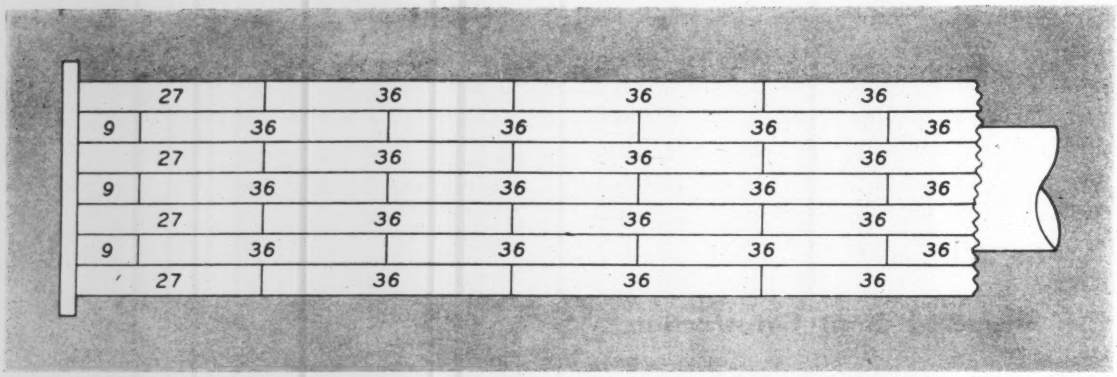
1 CORK COVERED LINE, which was lagged on ground, ready for hoisting into position is shown here. Cork has been hot asphalt vapor sealed and roofing paper has been installed for weather protection. Wood slat slings are used to hoist line so cork will not be crushed

Install Bands on Each Course

After each course is installed, galvanized or stainless steel bands are placed on 4½ in. centers or four bands are installed between each 18 in. joint distance. On the smaller OD insulated pipe sizes, 12 ga or 14 ga copper coated steel wire may be used as indicated in Table 5. The band material recommended is ½ in. wide × 0.015 in. thick or ¾ in. wide × 0.035 in. thick. On cork thicknesses over 4 in., the ¾ in. band is recommended for all pipe sizes on 4½ in. centers so that the



2 PREASSEMBLED HALF CYLINDERS may be applied to line as shown here. The authors experience indicates that special precautions must be taken to get cylinder edges to butt evenly and tightly



3 STAGGERED JOINT LAG installation is illustrated here. The 36 in. lags for one-half of a course are cut 9 in. from one end. The 27 in. and 9 in. pieces are installed tight against a flange to make one course around the pipe to start the staggered joint construction. The starting course could be made with alternate lags of 18 in. and 36 in. lengths. However, when one-fourth of the number of lags required per course is an odd number, some of the insulation may be wasted with this alternate method.

covering can be more securely tightened without breaking into the cork as might happen with wire. When wire is drawn too tightly it will cut into the cork in time and thus release the compression of the cork against the pipe and against the adjacent piece.

In areas where excessively moist conditions exist or where corrosive vapors are apt to be present such as ammonia fumes, etc., stainless steel bands should be used of the same size as for galvanized bands. Even though galvanized bands may be vapor sealed with the cork, an unattended exposed band can corrode through in time and its usefulness destroyed, allowing the cork lags to open up.

The bands of both materials are secured with band seals or clips which are applied with a special tool.

The close centers of the bands (4½ in.) are necessary to obtain spans between the bands such that no bulging of the cork will take place after a time to cause the seams to open up and the ultimate destruction of the insulation. The extra cost of labor and material in this instance is very small compared to the total cost of any project and is easily justified by decreased maintenance.

Seal Against Moisture Migration

After the lags are in place a seam filler should be applied to provide a smooth surface and then the vapor seal brushed on. An alternate finishing operation that may be applied in one coat is a heavy mixture of static emulsified asphalt mixed to a trowelling consistency with short fiber asbestos. This provides a heavy vapor seal that is impervious to moisture and is easily finished to a smooth even surface. About an ⅛ in. thick coat does a good job. On outdoor lines roll roofing is then applied for weather protection.

Stagger Joints of Molded Covering

Sectional covering is best installed with staggered joint construction in a manner similar to the lagging procedure. The first half cover is cut into a 9 in. and 27 in. length and installed next to a fitting or flange. Each succeeding half section is butted up tightly. The adhesive cement is applied to only one half of the section length and to one end as it is installed. Each succeeding half section then carries the cement to the uncoated half previously installed. The author's experience suggests that the joints between halves should be horizontal to decrease maintenance costs in case of failure due to moisture, etc. If a failure occurs, the bottom half usually fails first.

The bands are applied as the sections are installed using ½ in. bands on 4½ in. centers. The bands and seams are then coated with a heavy vapor seal and the job is complete unless decorative painting is required.

On outside lines, roll roofing is applied the same as with lagged lines, leaving a 2 in. space at the bottom of horizontal lines and completely covering vertical lines. The roofing is held in place with ½ in. bands on 9 in. centers.

How to Cover Fittings

On small fittings and valves, molded sections are commercially available and are easily installed using wire and bands to secure the sections. The sections should be cemented as they are installed.

On sizes larger than 6 in. pipe, it is sometimes more advantageous to make up the fitting covers using lags. In either case, the fitting cover should fit tightly over the adjacent pipe covering.

Adjoining flanges are covered in a manner similar to pipe, one lag at a time or in prefabricated half cylinders of the proper diameter to give a close fit to the flange.

Large valves, tees, and mitered elbows may be covered with prefabricated lagged half cylinders mitered to form the section. To get the proper lag bevel and to assure a good fit of the covering, a template should be used of the same diameter as the pipe fitting to form the half cylinders. The lags should be cemented together and drawn up tightly. When the cement is hard, the assembled covering can be handled and cut to the proper shape.

After the cover is installed and wired and strapped securely in place, the voids remaining between the cork and the fitting should be filled with hot granulated cork and paraffin poured through small openings cut in the top of the cover. For safety in handling the hot liquid paraffin, especially at elevated locations, the paraffin should be a low melting point type. Commercial grade match wax with a melting point of 108 F is available and suitable for this purpose. The cork cover must be tight so as not to allow the liquid paraffin to leak out. The pouring holes should be plugged and sealed over.

If environmental fire hazard is high or for other reasons the paraffin void filler should not be used, a trowelled-on mixture of cork-impregnated mastic can be used successfully. This material is available, mixed and ready to use. All remote voids must be filled and the fitting cover firmly impressed into the pliable material.

The lagging of valves requires a little more care than totally enclosed fittings since the stuffing boxes must be left exposed. The cork must be thoroughly sealed at this area. Where liquids are being piped that would be detrimental to the cork resin, vapor seal, etc., in case of a stuffing box leak, extra precautions must be taken to protect the covering. One successful method used is a galvanized sheet metal shield installed on top of the cork around the stuffing box. The joint between the cork and pan must be sealed with a suitable gasket material.

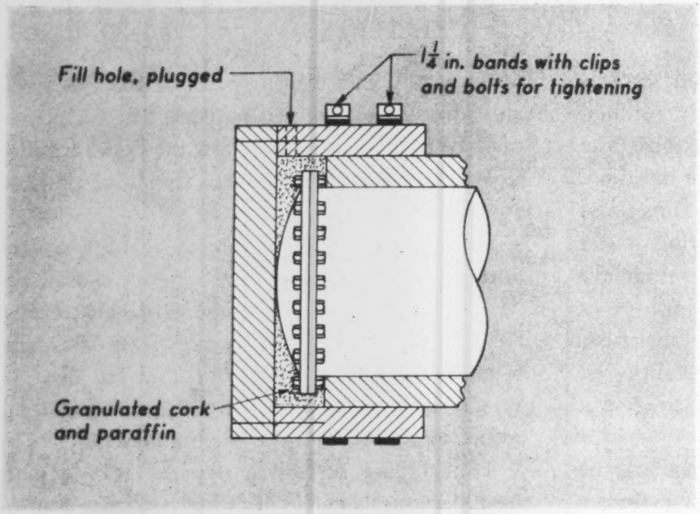
The fitting covers should be thoroughly vapor-sealed, and on outside lines, roofing felt should be applied leaving a 2 to 3 in. gap in the roofing at the bottom. Both bands and wire are usually necessary to bind the cork and roofing felt.

How to Apply Lags to Tanks

Lags are applied to tanks in much the same manner as to pipe, using the staggered joint construction. Tanks used at 0 F or below usually should be supported from outside of the insulation. At these points of support, alternate lags of wood are inserted. The wood should be a hard wood, such as oak, and treated with hot paraffin or a good wood preservative. If the supports must be attached to the tank, they should be insulated to prevent frost migration and damage to cork.

For diameters up to about 4 ft. ¾ in. bands on 4½ in. centers are satisfactory. On tanks over 4 ft, 1¼ in. by 16 ga bands on 4½ in. centers should be used. These bands are drawn tightly by angle clips riveted to the band ends and drawn up with a long threaded bolt. On tanks over 6 ft in diameter, two pairs of clips per band are recommended to get enough draw-up distance. Tank covers should be thoroughly vapor sealed using two coats of static emulsified asphalt mixed with short fiber asbestos trowelled on. On indoor jobs where a smooth painted surface is desirable, a light vapor seal with one or two coats of a hard finish Portland asbestos cement mixed half and half may be used. This is followed by the normal sizing and painting operation. All of these materials are commercially available.

Tank ends, whether flat or curved, may be covered with flat sheet cork cemented and fastened with wood skewers. Cover rings are applied over the flanges to seal the flat cover disc to the round shell. The voids are filled with granulated cork


Fill hole, plugged
1¼ in. bands with clips and bolts for tightening
Granulated cork and paraffin

4 FLAT INSULATION COVER for tank ends is illustrated here. After cover has been sealed, voids are filled with mixture of granulated cork and paraffin or other suitable void filler

and paraffin or other void filler. (See Fig. 4)

On shells that require head removal periodically for cleaning, such as refrigeration coolers, less damage is done to the cork if it is carefully fitted to the head contour and cemented in place. At the flange, a cork ring or cover is applied which, when removed, exposes the flange bolts and nuts for access. Hair felt is packed around the bolts when the flange covers are installed. No paraffin is used with this method. When the head is removed, the insulation remains attached to the head and thus has a long service life at minimum cost.

Another method of covering heads that require frequent removal involves the fabrication of a sheet metal cover lined with the proper thickness of cork. This cover is attached to the tank by means of metal clips welded to the tank head. Voids between this flat cover and a curved head should be filled with dry granulated cork through a hand hole in the top of the metal cover. When the void is filled this opening should be carefully plugged with cork and sealed. The joint between the edge of the metal cover and the cork on the body of the tank should be carefully sealed. The advantage of the metal cover is that it provides protection for the insulation and can be removed many times with very little maintenance required.

When insulation thickness exceeds 6 in. on tanks of say 48 in. diam and larger, it is better to install the cork in two courses to insure a good fit. Each course should be banded and vapor sealed as if each were installed alone.

Fill Voids to Prevent Ice Formation

In former days, brine putty was used as the standard void filler. This material was hard to work into all voids and usually had to be applied to a fitting before the cover was applied. Unless a very careful job was done, voids were not always completely filled resulting in possible ice formation if the vapor seal on the cork became punctured.

If leaks developed in the pipe connection at a fitting, or a piping alteration was required, or cork removal was required to remove a flange cover or tank head, the brine putty was very difficult to remove.

The use of paraffin and granulated cork in the voids eliminates these disadvantages and saves installation labor as well. It also insures filling of the remotest voids. The cork fitting must be tight so that the liquid paraffin will not leak out before it has hardened.

In selecting the paraffin, the job situation should be kept in mind. Various paraffins are available with different melting points. To eliminate the hazard of burning a workman while handling the liquid paraffin, especially at elevated locations, a low melting point wax should be used. Crude paraffin match wax with a melting point of 105 to 108 F is satisfactory for this service. This paraffin has been tested down to −30 F and did not become brittle. It has been used satisfactorily on large fittings of a brine system operating at temperatures as low as −100 F.

After the fitting covers have been installed in place, several holes 1 to 1½ in. in diameter are cut in the top of the cover and the liquid granulated cork and paraffin mixture poured in until the holes are nearly filled. Cork plugs are then inserted in the holes and made flush with the cork cover surface. The fitting is then vapor sealed and if located outdoors, it should be covered with roofing felt.

The granulated cork particles should be small enough to flow with the paraffin to the remotest voids. The maximum size should be not over about ⅛ in. across. The proportion of granulated cork to use in the paraffin should be such that a flowing mixture is obtained.

On some installations where the cork cover is applied and built up progressively, such as the head covers of large horizontal tanks, the granulated cork may be poured in dry. When the head cover is completed, melted paraffin is poured into the cork filling until it is full. This method saves the labor of mixing the cork and paraffin and does a satisfactory job.

On lines subject to prolonged shutdowns, which are located in warm or hot areas indoors or exposed to a hot sun outdoors, 108 F melting point paraffin will become soft and will tend to creep out of a fitting that is not tight initially or has been damaged in service. For this service a higher melting point wax is preferable. However, when this choice is made, the increased handling hazard must be recognized.

Paraffin is inflammable and precautions against fire must be taken. The safest way to melt paraffin is in a steam coil heated tub of hot water into which is suspended the container of paraffin. During installation, no welding or metal burning should be allowed above the work or in the immediate vicinity. Paraffin spills or drippings should be cleaned up immediately. This is best done after the paraffin has solidified when it can be scraped up.

Carefully Consider Hanger Loading

On insulated lines it is preferable to support the pipe from outside the insulation. Metal to metal contact with a cold pipe line through the insulation always invites ultimate difficulties with the insulation at the hanger. Hanger rods sweat or frost and eventually the vapor seal breaks down and moisture migrates into the cork where ice forms and splits open the covering. The process is progressive and accelerates with time.

Regular cork molded covers or lags are capable of carrying some compression load. However, this loading must be kept below the point where the cork deflection will break the vapor seal. Experience and tests indicate that the maximum loading should not be over 7 psi based on the projected area of the pipe for standard cork and not over 25 psi for heavy density cork.

In order to distribute the loading on cork at points of support, steel saddles of half cylinder design should be used. On lines, usually below 8 in. size and with short spans, steel saddles can be used on regular cork. They must be of sufficient length to hold the cork compression load to not over 7 psi. This load will produce a deflection in the cork of 12½ to 15 percent of the original thickness depending on the density of the cork.

When this design requires an excessively long saddle, it is best to use a heavy density cork section under the saddle. Heavy density cork is a high load carrying cork and is available in 12 in. × 36 in. sheets in the standard thicknesses. These sheets are finished with asphalt paint on both sides and are easily cut into lags. High density cork is not available in molded sectional design. Its density varies from about 16 to 20 lb per cu ft. Standard cork has a density of 7 to 8 lb per cu ft.

Tables 14 and 15 are schedules of pipe saddle dimensions and are calculated with 7 psi as the maximum compressive load on regular cork and 25 psi maximum load on heavy density cork. The saddles are installed as shown in the figures accompanying the tables. An overlap in the schedules between the 8 and 12 in. sizes is intended to be used for either molded covering or heavy density lags. Shorter saddles can be used when the heavy density lags are used under the saddle. In order to standardize with fewer saddle lengths, several designs have been combined. However, in all cases the cork compression load will be less than the design load. The saddles are made of hot rolled carbon steel and should be prime painted before installation.

Good Hanger Design is Essential

Having calculated the hanger loading from the data in Tables 3 and 4 and having selected the proper saddle length from Table 14 or 15, the application of the support must be determined. As mentioned earlier regarding outside lines, it is easier to install the cork on the pipe on the ground before erection. The saddles can also be installed on the ground, but accurate measurements must be made to be sure the saddle and heavy density cork, if used, are properly located.

Before the saddles are installed, the cork should be thoroughly vapor sealed with a heavy coat. It is also best to paint the saddles inside and out with asphalt or graphite paint, or they may be dip-painted in hot asphalt. The dip-paint should be done after channel iron sections, if used, are welded to the saddles.

If the line is to be supported from above with a pipe clamp around the saddle and a hanger rod, then the bare saddle may be strapped in place on the cork covered line using ½ in. wide galvanized bands.

For below line support, a short length of channel iron should be welded to the saddle before it is applied to the cork. The channel iron helps to distribute the load on the curved channel and overcomes its tendency to open up under load. The pipe clamp used on overhead supports overcomes this tendency by the nature of its application.

Under line supports may be a trapeze arrangement with hanger rods or a rigid structural support. To allow for movement in the line, rollers should be used between a rigid support and the saddle assembly. If commercially available pipe support rollers are used, the channel section on the saddle may be omitted. The rollers should be of solid section, not pipe, to prevent internal corrosion. The rollers are set in channel sections with the legs looking up. Small bars should be welded across the open ends of the channels to prevent

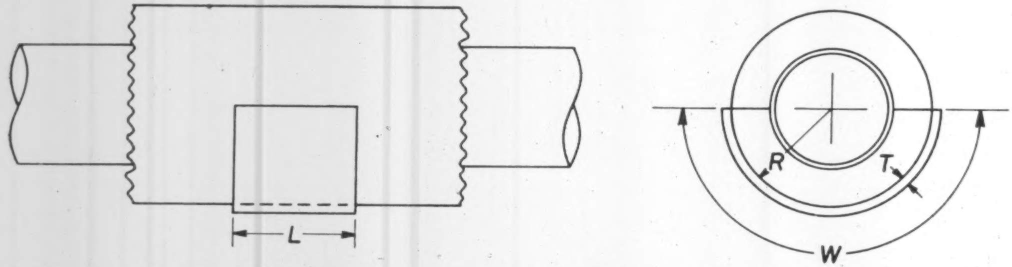


TABLE 14 — SADDLE DIMENSIONS for use over molded sectional cork pipe covering are listed here. Dimensions, which are illustrated in figure above, are: L, length of saddle, in.; T, thickness of metal from which saddle is made, in. or ga; R, outside radius of cork covering or radius of saddle, in.; W, one half the circumference of cork covered pipe or developed width of saddle, in.

Pipe size, in.	Hanger span, ft	Light duty				Standard duty				Heavy duty			
		L	T	R	W	L	T	R	W	L	T	R	W
½	10	5	16 ga	1⅝	5	5	16 ga	2⅛	7	5	16 ga	3¼	10
¾	10	5	16 ga	1⅞	5½	5	16 ga	2⅜	7	5	16 ga	3¼	10
1	10	5	16 ga	2⅛	7	5	16 ga	2⅝	8	5½	16 ga	3⅝	11
1¼	10	5	16 ga	2⅜	7	5	16 ga	3¼	10	6	16 ga	4	12
	15	8				7½				9			
1½	10	5½	16 ga	2⅜	7	5	16 ga	3⅜	10½	6	16 ga	4	12
	15	8				8				9			
2	10	5½	14 ga	2⅝	8	5½	14 ga	3⅝	11	6	14 ga	4½	14
	15	8½				8½				9			
	20	11				11				12			
2½	10	6½	14 ga	2⅞	9	6	14 ga	4	12	6	14 ga	4½	14
	15	9½				9				9			
	20	13				12				12			
3	10	8	14 ga	3⅜	10½	6	14 ga	4½	14	6½	14 ga	4⅞	15
	15	10				9				10			
	20	13½				12				13			
4	10	7½	⅛	4	12	7½	⅛	4⅞	15	8	⅛	5⅝	17
	15	11½				11½				11			
	20	15½				15				14½			
5	10	8½	⅛	4½	14	8	⅛	5⅝	17	8	⅛	6⅝	20½
	15	13				13				12			
	20	17½				17				16½			
6	10	9½	⅛	5⅛	16	9½	⅛	6⅛	19	9	⅛	7⅜	23
	15	14½				14½				13½			
	20	19				19				18			
8	10	11½	⅛	6⅛	19	11½	⅛	7⅜	23	11	⅛	8⅛	25½
	15	17				18				16			
10	10	13	3/16	7⅜	23	13½	3/16	8⅝	27	13	3/16	9⅜	29½
	15	20				20				19			
12	10	15½	3/16	8⅛	25½	15½	3/16	9⅝	30	15	3/16	10½	33
	15	23				23				22			

the roller moving out of the channel endwise. The roller channel is welded to the structural support member, the roller set in, and the pipe with saddle and channel set on top of the roller. Since the area of the roller is rather difficult to keep painted, it is best to apply a coating of waterproof grease during the installation.

When it is impractical to install the cork and saddles to the pipe before erection, the pipe is hoisted and set into the saddles lined with the supporting cork. With overhead support using pipe clamps over the saddle and cork, the pipe is raised to its approximate location, the clamp put around the pipe and fastened to the hanger rod, the cork lined saddle slipped in place under the clamp and the pipe lowered into the saddle. The clamp is then tightened and the hanger rod adjusted for proper pipe elevation.

On outside lines where roll roofing is required, the roofing should be installed over the saddle before the pipe clamp is installed. Or for under line support the roofing should be brought down over the saddle to the support point and strapped in place. In no case should the saddle be installed over the roofing.

The pipe support may be any one of a variety suitable for the job. A hanging support is usually the best and is often the least expensive installation for an insulated line. Pipe movement due to temperature change is automatically taken care of with a hanging support. Some of the supports successfully used for cold lines are rollers with rigid supports, "U" rods under the saddles, trapeze under the saddle, half pipe clamps with two rods, single pipe clamp with turnbuckle and rod, and various combinations of these with springs.

No pipe line is any better than the supports and hangers that keep it in place. Therefore, no support should be installed that cannot easily be maintained and kept free of rust. Probably the greatest single fault in support design is that of having structural members so close together that the back to back surfaces cannot be painted when required. Bracket or trapeze supports made of channel sections back to back should have a space of at least 2 in. to allow a painter's brush to cover all surfaces easily. When structural members are welded together on outside service, the joints should be seal-welded at all lines of contact to prevent moisture accumulation between the touching surfaces.

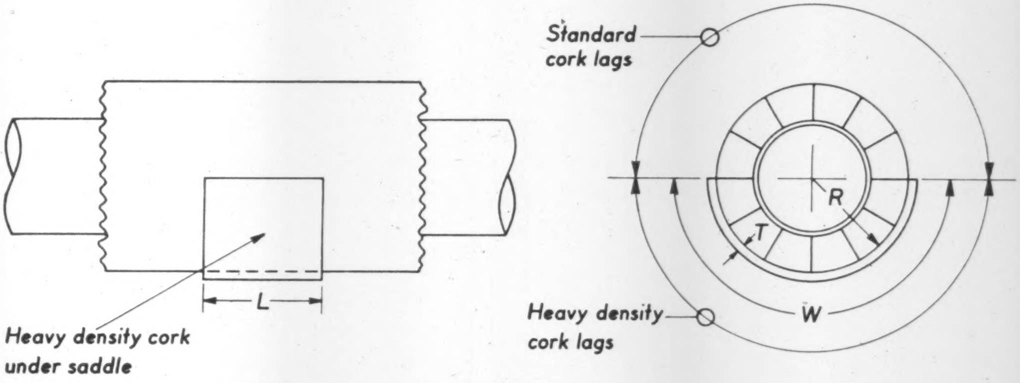
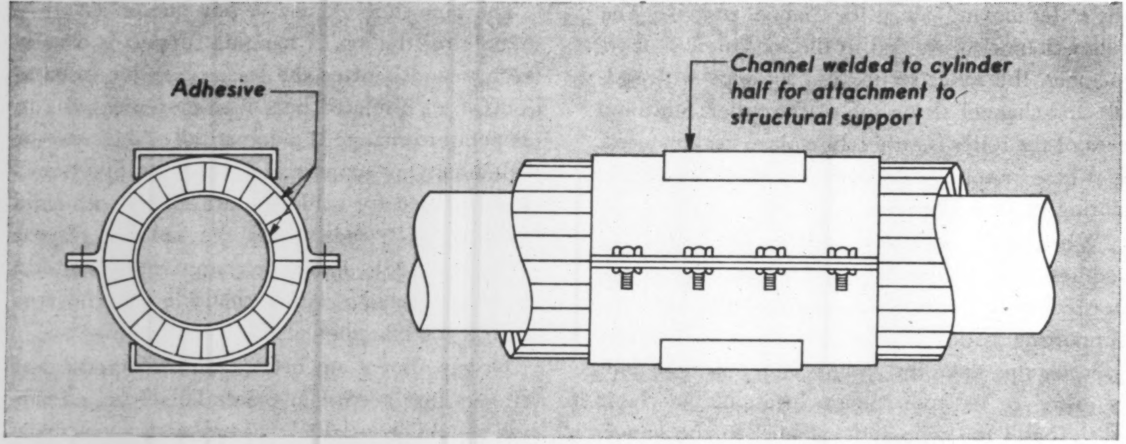


TABLE 15 — SADDLE DIMENSIONS for use over heavy density cork pipe lags are given here. Dimensions, which are shown in figure above, are: L, length of saddle, in.; T, thickness of metal from which saddle is made, in. or ga; R, outside radius of cork covering or radius of saddle, in.; W, one half circumference of cork covered pipe or developed width of saddle, in.

Pipe size, in.	Hanger span, ft	Light duty				Standard duty				Heavy duty			
		L	T	R	W	L	T	R	W	L	T	R	W
8	15	6	3/16	6⅛	19	6	3/16	7⅜	23	6	3/16	8⅛	25½
	20	8				8				8			
10	15	7	¼	7⅜	23	7	¼	8⅝	27	7	¼	9⅜	29½
	20	9				9				9			
12	15	8	¼	8⅛	25½	8	¼	9⅝	30	8	¼	10½	33
	20	11				11				11			
14	15	8	¼	8½	27	10	¼	10½	33	10	¼	11	34½
	20	11				13				13½			
16	15	8½	¼	9½	30	10	¼	11½	36	11	¼	12	38
	20	11½				13½				14½			
18	15	8½	⅜	10½	33	11	⅜	12½	40	11½	⅜	13	41
	20	11½				14				15			
20	15	9½	⅜	11½	36	11½	⅜	13½	42½	12	⅜	14	44
	20	12½				15				16			
24	15	11½	⅜	13½	42½	12½	⅜	15½	50	13	⅜	16	50
	20	15				17				17½			
	25	17				21				22			


Adhesive
Channel welded to cylinder half for attachment to structural support

5 ANCHORS are sometimes needed to prevent piping strains and excessive movement in pipe lines. Representative anchor design is shown here for use when it is desirable to place anchor on outside of insulation to minimize sweating and dripping of metal parts

Suggested Anchor Design for Piping

Sometimes the need arises for an anchor on an insulated line to prevent piping strains or excessive movement of connecting lines, etc. The designer must then decide whether to anchor the bare pipe and insulate the anchoring members adjacent to the cold line or to install an anchoring device outside the cork covering. The operating temperature of the line to be anchored has a bearing on this decision.

On insulated lines carrying fluid at or below the dew point of the ambient atmosphere it is usually best not to have any metal support items touching the bare pipe. This will eliminate sweating and dripping of the metal parts, which may result in cork damage. This can be overcome, of course, by covering part of the metal item and maintaining the vapor seal.

On lines operating at or below 32 F, it is always best to avoid metal to metal contact between hanger and pipe.

The anchor to be described here is suitable for all cold insulated lines. It is inexpensive, and has proven satisfactory in service on large pipe lines with 6 in. of cork insulation and designed for −100 F operating temperature.

On a now existing 16 in. refrigeration distribution line designed for −100 F operation, the length of one section was such that the total movement due to temperature change from atmospheric to operating temperature was calculated to be 13 in. This line and the parallel 16 in. return line were connected by numerous 4 in. lines running to production equipment. In order to reduce lateral movement in these 4 in. lines, each 16 in. line was divided into four quarters with an expansion loop in the center and an anchor on each side of the loop at the quarter points.

A typical anchor designed and used in this installation is shown in Fig. 5. It consists of two steel half cylinders 30 in. long with flanges running parallel with the pipe and heavy density cork lags installed completely around the pipe under the steel half cylinders. The cork is cemented to the pipe, vapor sealed, and then the half cylinders are cemented to the cork and drawn down by bolts until the cylinder flanges come together.

The cylinder halves were designed so that when the flanges were tight a calculated compression of about 13 psi was set up in the heavy density cork against the pipe surface independent of any span load. Based on shear tests on heavy density cork, this loading with a 24 in. long cylinder was calculated to provide sufficient resistance to shear in the cork between the pipe and anchor cylinders to safely hold a calculated 6000 lb pull. For this 13 psi load, the amount of clearance between the untightened steel cylinder halves was calculated from compression test curves to be ⅜ in. For a given load, flange clearance varies with cork thickness. In this case with 6 in. thick cork and 13 psi load, the deflection was about 3/16 in. and the total flange clearance before tightening was ⅜ in.

The remainder of the load carrying capacity of the cork on the under side of the line would be used to carry the span load. Thus the minimum length of the cylinder was fixed using $(25-13)$ or 12 psi as the design load of the span.

As a result of tests and based on the pipe surface in contact with the heavy density cork under the cylinder, a shear value of 5 psi was used in calculating the minimum length of cylinder required.

The anchors in use were designed for a 6000 lb line pull. The cylinder lengths required were calculated to be 24 in. long for shear and 27 in. long to carry the span on the 16 in. lines with span loads of 5200 lb. The cylinders installed were made 30 in. long to increase the safety factor. They were made of ½ in. plate with four ¾ in. bolts on the flanges on each side. Lateral movement in the cork was calculated to be not over 1/32 in. due to deflection.

After more than six years of operation, none of the six anchors, patterned after the above, has shown any evidence of failure, slippage, frost, or any other defect.

If a line is to be guided only, such as would be the case with an expansion loop, etc., a variation of the above anchor would be quite successful. A lower initial compression in the cork and a much shorter cylinder would be used since the longitudinal forces along the pipe due to the reaction force of the guide would be so low as to set up a negligible shear force in the cork. If the lateral force of the guide was small, the cylinder could be installed over the regular cork covering and the length calculated accordingly.

To check the design of these anchors, tests were made on specimens simulating actual field installation. Four test pieces were assembled using 6 and 8 in. pipe with 2, 3, and 4 in. thick heavy density cork lags clamped to the pipe with steel half cylinders. All of the lags were 12 in. long.

During the tests, the cork deflection was allowed to stabilize with a constant load on the test machine, and the deflection was measured. Then the specimen was unloaded, and the permanent deflection measured. These tests indicated that the 5 psi shear load used in the anchor design was conservative. However, this was necessary to insure against excessive cork deflection or non-uniformity in the materials used, and the quality of workmanship during the anchor installation.

It was discovered during these shear tests that the cork cement normally used on the cork lags, fitting covers, etc., was not satisfactory for use in anchors. When literally sealed up by the nature of the long cylinder and pipe surface, the volatile materials could not escape and the cement did not dry. On subsequent tests, the air drying type cement was abandoned and chemically hardening cement was used.

Vapor Seal is Essential to Service Life

The primary purpose of a vapor seal is, as the name implies, to prevent the migration of atmospheric moisture into the insulation to cause icing and ultimately failure. The question of whether or not to use one vapor seal for indoor high humidity areas or another vapor seal or one with lesser thickness for outdoor installations should never be considered. The best possible vapor seal is equally important in both dry or damp areas since insulation failure due to moisture migration through a poor vapor seal is simply a matter of time depending on the amount of ambient moisture available. The end results of improper vapor sealing are always the same — costly maintenance or replacement.

Pipe lines that are kept under constant temperature load are less susceptible to cork failure than lines in intermittent service. Lines that are alternately warmed up by weekend or daily shutdowns and cold during "factory" hours must be checked more frequently to maintain the vapor seal to avoid moisture migration and ice formation. Ice, with its wedging action, in a short time will split open a fitting cover or covering on the pipe, even at some distance away from the vapor seal break by water migration along the pipe.

The covering is destroyed by ice forcing the cork apart until it drops off or by trapped moisture within the covering breaking the bond between the cork particles, causing the particles to drop from the line. This can occur in either horizontal or vertical lines. Because the moisture will travel under the cork covering and destroy a perfectly sealed section of covering, it is important that the vapor seal around valve bonnets or any other bare metal extending through the cork be carefully installed and maintained water-tight.

A vapor seal found to give satisfactory results, and to have no harmful solvent fumes, is a mixture of emulsified asphalt and short asbestos fibers. This seal material may be mixed on the job or obtained commercially. This mixture is used where heavy coats are desirable such as on tanks or other large surfaces. Also, the asphalt alone may be painted on cork surfaces, which have a factory installed surface asphalt coating, after the seams and joints or other surface imperfections have been filled with seam filler.

Hot roofing asphalt has been used as a vapor seal. This material is mopped on, leaving a heavy coat. The asphalt has a tendency to crack with age and in extreme cold weather, and for this reason, does not appear to be quite as satisfactory as the more ductile materials, such as asphalt cut-backs. Limitations in some industries preclude using otherwise good materials because of product contamination by the chemicals in the vapor seal, or in some environments the vapor seal may be attacked by atmospheric chemicals. In these situations one might consider protective sealing of the offending vapor seal by an additional coating of paint, liquid plastic, latex, etc.

Protect Outside Lines from Weather

Cork covered lines located outdoors usually are subject to more total abuse from the weather than are indoor lines by their environment. This is especially true in areas where the climate is very seasonal with freezing and hot weather. It is good practice to shield outside lines with a protective cover after the lines have been vapor sealed.

A satisfactory covering is two ply, 65 lb, reversible finish, roofing felt. This material is tough, and waterproof, and does not require immediate painting. Usually the roofing should be painted in three to five years after installation, or whenever small cracks start to develop in the surface. A good asphalt paint then should be used or possibly a metallic paint such as aluminum, which would reduce heat losses to a certain extent while it remained bright and clean. The roofing should be used as a cover and never installed to take the place of a vapor seal.

In some outdoor installations, a dual purpose vapor seal and weatherproof covering might be considered. Various wrapping fabrics are available which are installed spirally with an adhesive or waterproof material painted or trowelled on the cork. The wrapping must be completely saturated into the still wet waterproofing and when dry a heavy coat painted on the outside. This involves considerable labor and some complication at hangers and fittings, but if properly installed, it should give good protection to outside lines.

With roofing felt, experience has shown that the roofing should not be wrapped completely around horizontal lines. Some older outdoor brine lines which had been in continuous service for 10 or 15 years have been found to show serious deterioration of the cork on the under side of the horizontal sections. These lines were installed with the roofing felt wrapped completely around the lines and securely fastened with metal bands and staples. Metal grommets were inserted in the bottoms of the roofing to allow breathing between the cork and the felt. These grommets either became painted shut or were so tight to the cork that their purpose was defeated.

It was discovered that moisture had somehow accumulated in surprising quantity inside the roofing at the bottoms of the lines. The moisture had finally destroyed the cork resin causing the cork particles to fall out of breaks in the roofing caused by ice growth. This moisture probably was a result of condensing out of atmospheric moisture in the free air under the roofing. Even new lines installed by this method showed free water accumulation under the roofing at the bottom after only four years of continuous operation. The roofing on these lines was cut to make a 2 in. longitudinal opening on the bottom to prevent ultimate cork failure. The cork and vapor seal on these lines are still intact. Completely wrapped vertical lines are not subject to this type of failure, except at the bottom of the riser where drainage openings should be provided.

The recommended practice of installing the roofing felt with the bottom gap was begun in an experimental way several years ago on a large installation and its success appears to be proven. With this method the roofing is wrapped around a horizontal line with at least a 2 in. gap between edges at the bottom of the line. Each 3 ft wide strip is lapped 4 in. around the line. Galvanized or stainless straps ½ in. wide are installed on 9 in. centers with one strap over each lap. If the circumference of the covered line is smaller than about 38 in., the roll roofing may be installed lengthwise between hangers, cut to the proper width to provide the open gap at the bottom. This method is of no advantage on vertical lines and they are covered completely with 4 in. laps on each joint.

When galvanized metal bands are used they should be prime and finish painted with static emulsified asphalt paint prior to installation. They are not painted again until the roofing requires paint. The band painting may be done quickly by using large spools on which several hundred feet of the material are wound on one spool. The bands are brush or dip painted as the spools are rotated and the painted band material wound on the other spool.

Protect Covering from Mechanical Damage

Inside cork covered lines usually are more subject to puncture or abrasion than outside lines; however, both types of installation should be adequately protected from damage by this cause where required.

Vertical lines indoors, passing through a floor, should be protected by sheet metal guards securely wrapped around the cork after the vapor seal is installed. The height of the guard depends on the condition but should not be less than 3 ft. Indoor lines, either vertical or horizontal, that are subject to bumping should be adequately painted with the standard warning colors or symbols. Wood or steel bumper rails may be necessary where hand or power trucks are in use.

On outdoor lines heavier guard rails and bumpers are usually necessary. Lines passing over roadways should have the road clearance height clearly painted on both sides of the lines. Metal shields on outdoor overhead lines usually are not necessary. Bumper guards on vertical outdoor lines near the ground should be painted in warning colors.

Paint the Completed Job

Depending on the situation, indoor lines may be left black with just the vapor seal on the line or they may be finish painted to suit the area color scheme. Usually, from the lighting standpoint, it is better to paint indoor lines with some light colored paint.

So that the asphalt in the vapor seal will not strike through the finish coat of paint, the lines should be prime painted with a good sealer. The adhesive cement, used by the author to install the cork, when thinned to a brushing consistency with alcohol makes a good primer. Other good primers are available, that are mixed and ready to use under oil or water base finishes.

All steel items such as structural members, hangers, saddles, etc., should be prime painted with oxide paint before erection. After erection of the lines, these items should be finish painted to match the color scheme on indoor lines. On outdoor lines, if black is a satisfactory color, the steel may be painted with graphite paint or static emulsified asphalt. The asphalt emulsion is water thinned and therefore is unsatisfactory to use in freezing weather; otherwise, it makes an excellent preservative of steel surfaces. Special coatings should be used where adverse gases or fumes are present.

Preventive Maintenance is a "Must"

Once a good job of cork installation has been accomplished, it should not be neglected. The old adage of a stitch in time saves nine is a very appropriate motto that might well be applied to cork insulation.

Frequent inspections and daily general observations are necessary to catch any unforeseen breakdown in the vapor seal. The lower the temperature in the lines, the more important these inspections become. This is important around equipment having the usual large number of valves and fittings. Intermittent insulation inspections will depend on past experience with like equipment. On well maintained lines, usually a yearly inspection of outside lines will be sufficient to catch defects. Indoors, where greater hazards to the cork exist, such as high humidity, corrosive vapors, etc., these inspections should be made more frequently, perhaps as often as once a month depending on experience. It is important to remember that a small break in the vapor seal at a valve stuffing box, hanger rod, or elsewhere, whether in a vertical or horizontal line, will invite moisture that ultimately will damage the covering for some distance away from the fault due to moisture migration.

When breaks are discovered, the repair should be made as soon as possible in order to minimize the repair and so that a shutdown will not be required to make a satisfactory major replacement job.

Leaking valve stuffing boxes should be tightened and the vapor seal around the stuffing box given special attention. Valves are probably the single greatest cause of insulation failure and deserve the attention demanded by their importance. This is especially true of operating valves which are frequently used. If covering is to be replaced, it is always best to do this with the line or fitting defrosted and not sweating. However, there will be situations when a fitting or short section of line operating at below freezing temperatures must be covered but cannot be shut down for warm up.

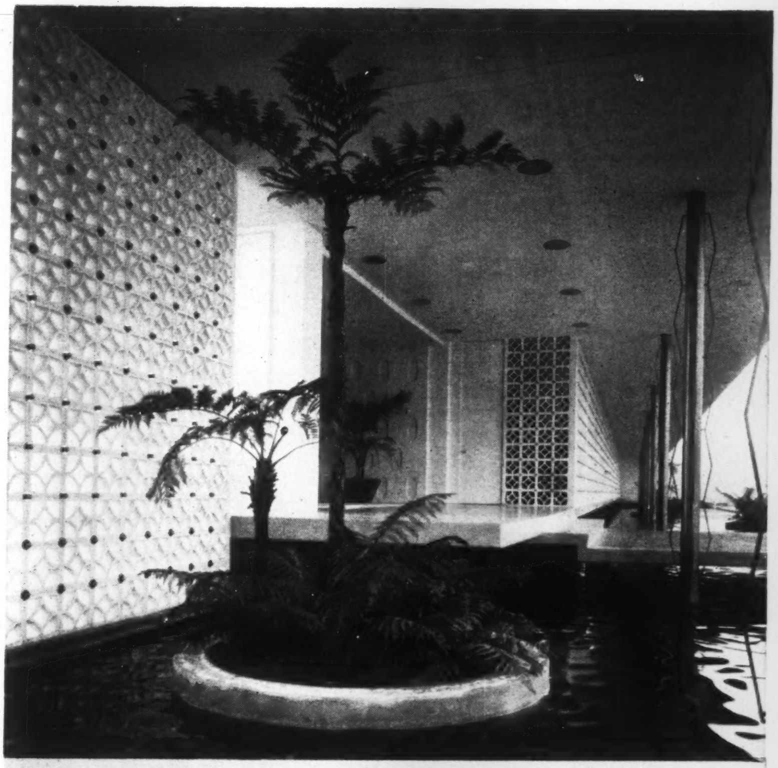
When an uncovered new connection is made to an operating line at low temperature, the ice buildup is fairly rapid. To cover such an area, the ice must be chipped off as close to the pipe as possible. Then the rest of the ice should be removed by washing with denatured alcohol. The cork is fitted to the line or fitting, and adjustments made to get a perfect fit. The cork is removed and a final alcohol wash made to remove all possible moisture. The cork is then quickly placed in position and secured. On a fitting, the paraffin and granulated cork is poured in to fill the voids as quickly as possible after the fitting is made liquid tight. The assembly should be fitted tightly against the existing adjacent covering. The surface of the cork is then vapor sealed in the usual manner.

Wires and bands broken due to corrosion or impact should be replaced as soon as they are found. Broken bands release the pressure holding the cork in place. The cork so released will soon crack open at the joints and then progress ultiately to complete failure. The recommended spacing of bands is 4½ in. to reduce the span between bands, and thus to better insure that the whole length of the cork cover will remain tight to the line. A broken support doubles this span and causes the cork section to deflect away from the pipe.

If the cold fluid being handled in a pipe line is damaging to cork, vapor seal, or the finish paint, special precautions should be taken to prevent this damage due to a leaking stuffing box. Some fluids in the halogenated hydrocarbon family fall in this category. Calcium or sodium chloride brines are corrosive to bare metal in the presence of air and a leaking valve packing can allow serious corrosion of the pipe line under the cork if the cork is not kept sealed.

On systems carrying fluids that attack the covering materials, metal shields should be fabricated and fitted tightly around the valve stuffing box with suitable gasket material between. Synthetic rubber will withstand some fluids for this service. These metal shields may be galvanized sheet. They should have a lip around the outer edge or lower edge, as the case may be, and a small pipe or tube connected to carry away from the cork any leakage or water melted from the frosted portion of the valve.

Any mechanical installation, no matter what the first cost, is no better than the care it is given in service. An insulated pipe line or tank is one of the most fragile items of operating equipment in any plant and is probably more susceptible to failure due to neglect than most other plant facilities. Installation costs are high, but the difference in cost between a good construction job and a poor job is infinitesimally small. Also, the cost of maintaining an insulated pipe line properly, and above all at the right time, is small compared to that of a major repair job, which might include a service shutdown. In any case, improper maintenance would incur a heat loss during any prolonged period of deterioration. Therefore, to get the most out of the investment in an insulated piece of equipment, the best possible construction job using the best materials available for the service intended must be made and the job must be kept in first class condition.



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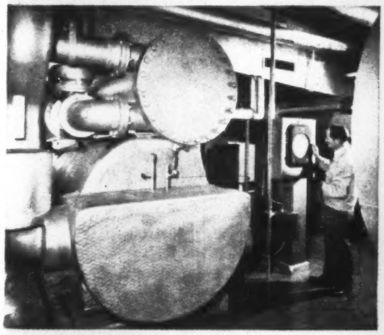

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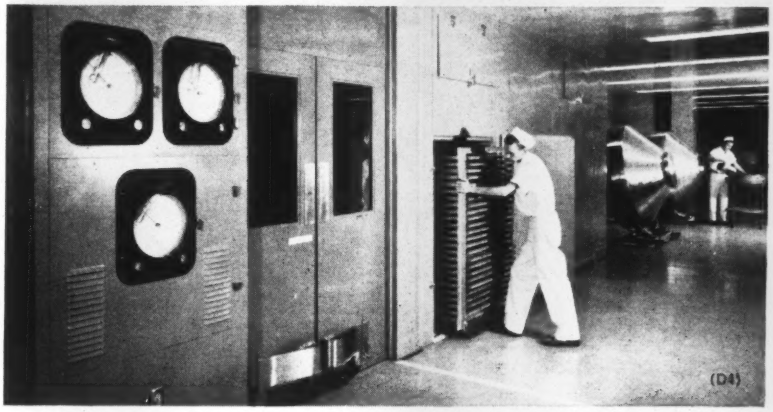

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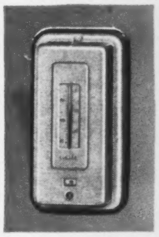

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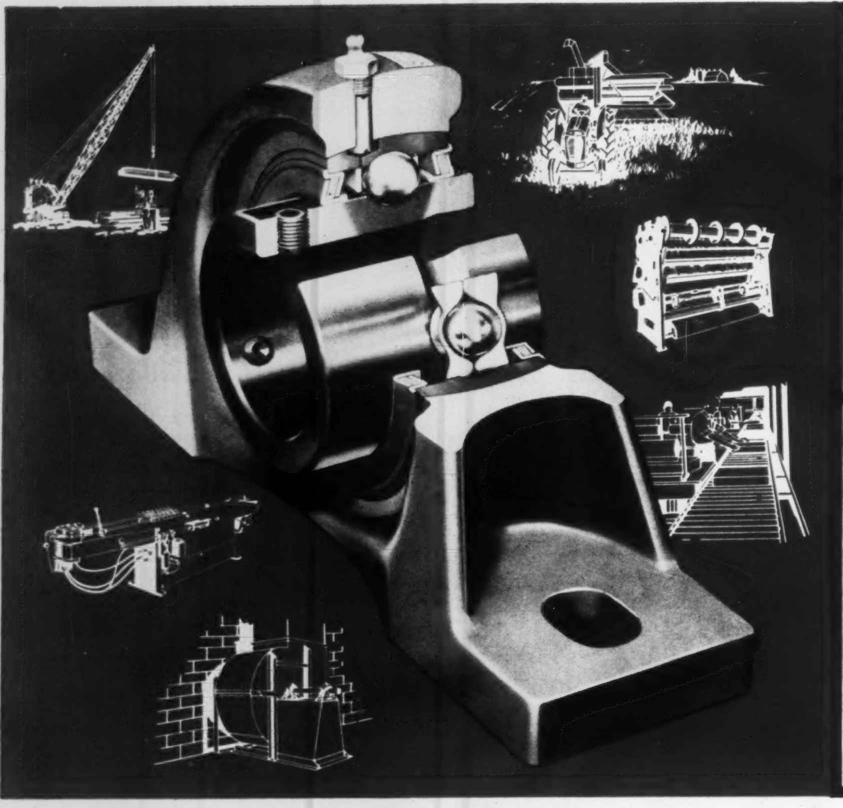

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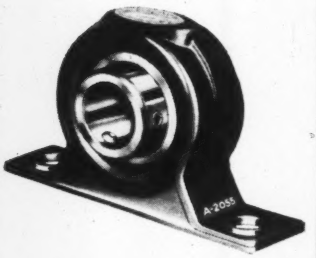

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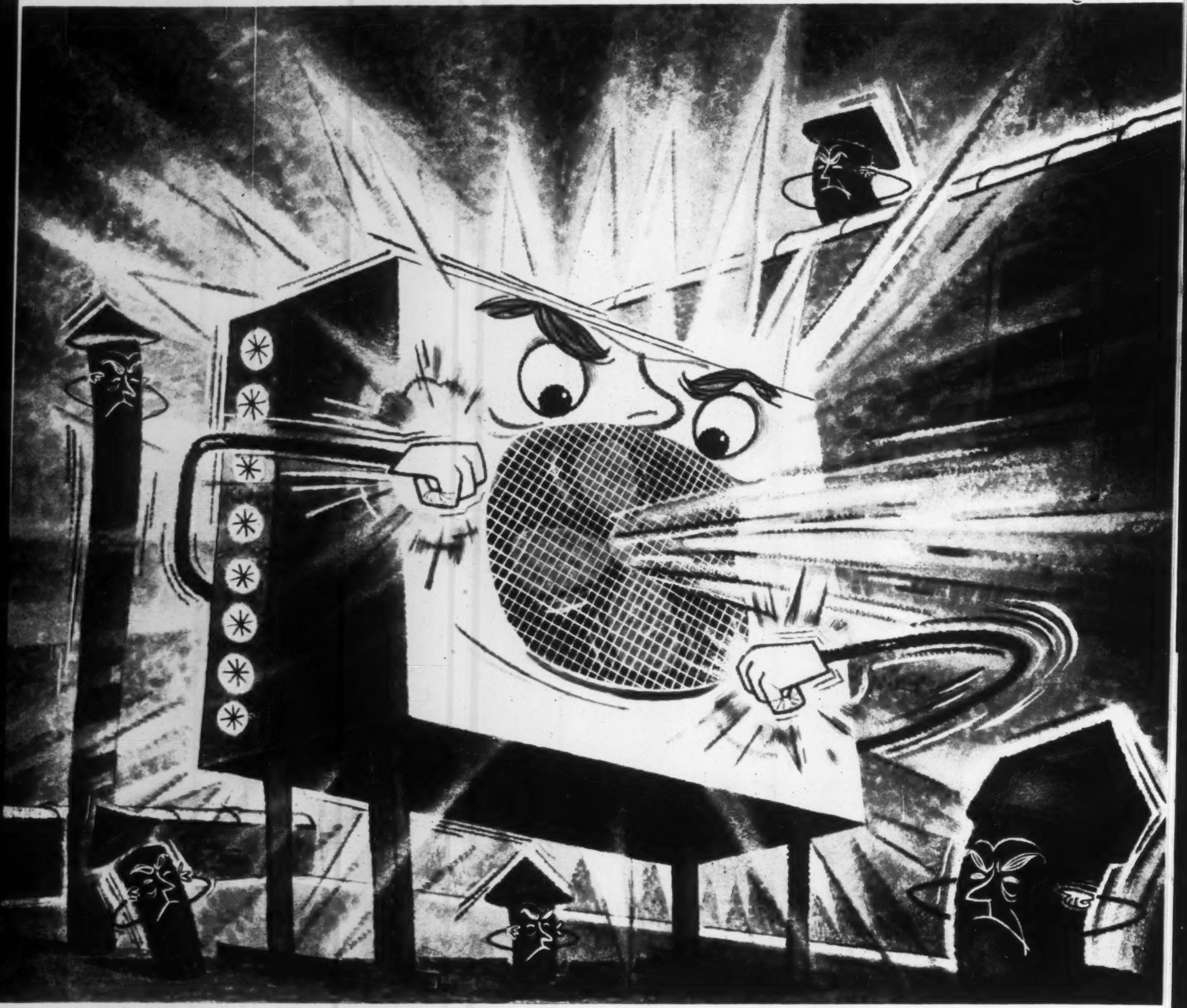

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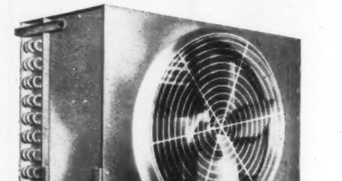

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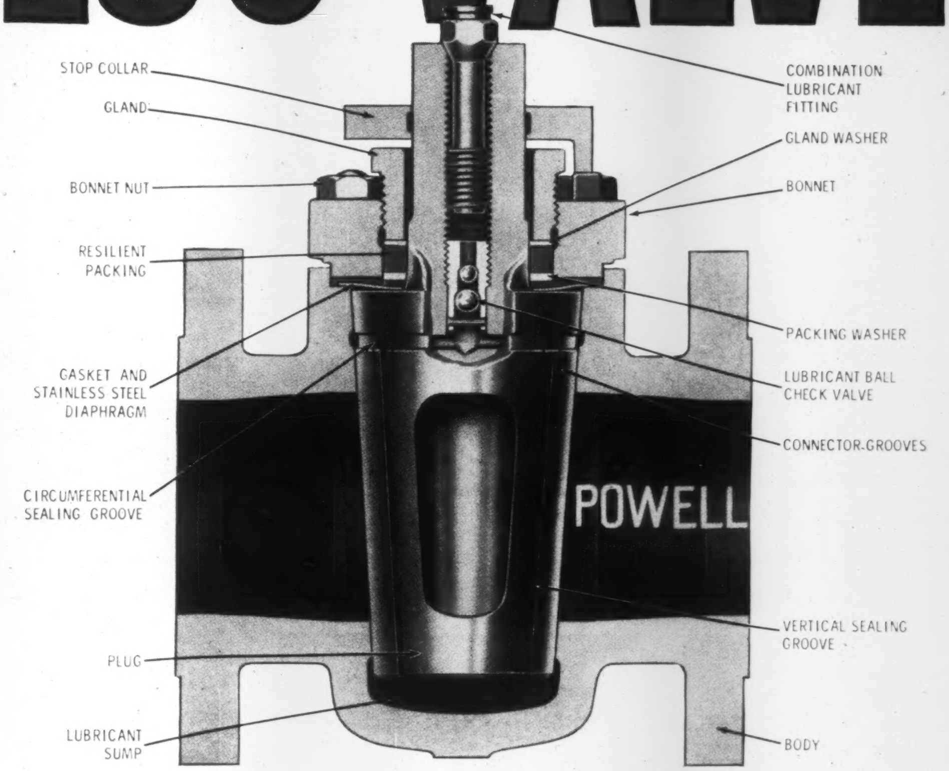
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Sectional view Powell Screwed Gland Lubricated Plug Valve.

Like all Powell Valves, Powell Lubricated Plug Valves are superior in their field . . . and have many advantages over other conventional types of Valves.

- Simple design: only three basic parts—Body, Bonnet, Plug.
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Powell Lubricated Plug Valves are available in sizes ½" through 16", depending on the type required—Semi-steel 175 and 200 pounds WOG;—Carbon Steel ASA 150 and 300 pounds.

Powell can also furnish Lubricated Plug Valves in other alloys on special order.

For all your valve needs, make it a policy to consult your local Powell Distributor—or write directly to us.

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Dependable Valves Since 1846 • Cincinnati 22, Ohio

In bowling alleys and banks, bakeries and beauty parlors... You'll find

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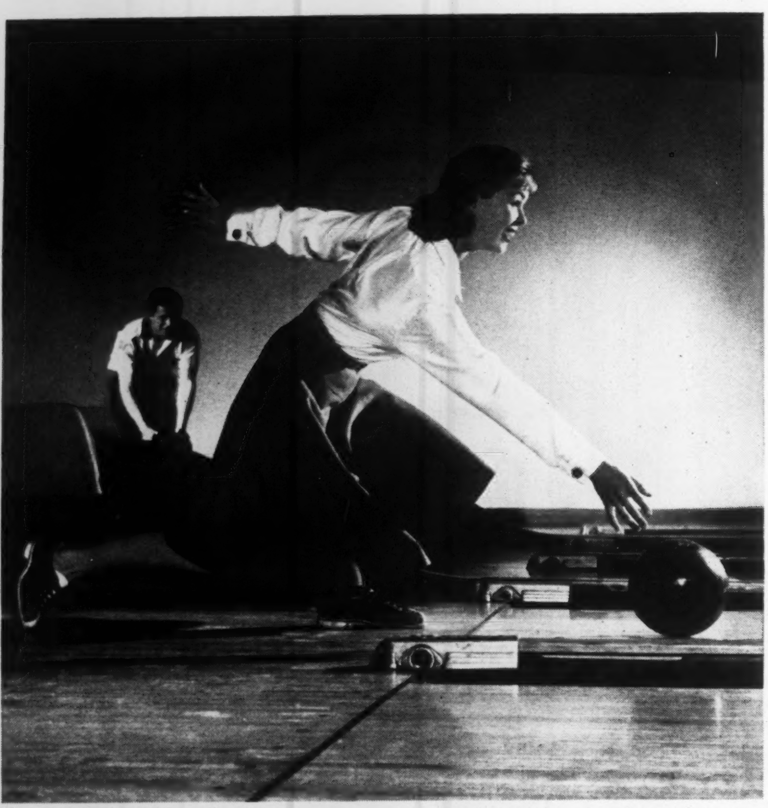
SUPER-DRY REFRIGERANTS



The popularity of bowling has increased so sharply in recent years that today more Americans actively participate in bowling than in any other indoor sport. Air-conditioned alleys have made it possible for bowlers to enjoy the game the year round.

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In thousands of applications, you'll find "Genetron" refrigerants filling the air-conditioning and refrigeration needs of modern America. "Genetron" refrigerants offer unexcelled purity and dryness . . . and their strict quality specifications are consistently *bettered* in production. Leading equipment manufacturers, refrigeration engineers and air-conditioning and refrigeration wholesalers approve, specify and recommend them. They know they can always count on "Genetrons" for dependable, trouble-free service.

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MONOCHLORODIFLUOROMETHANE

genetron 113 PURPLE LABEL $C_2Cl_3F_3$
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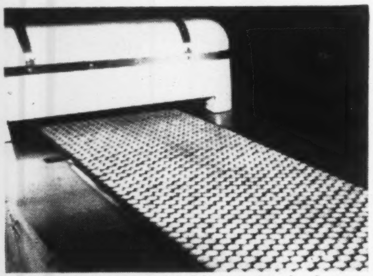
genetron 114a BLUE LABEL $C_2Cl_2F_4$
DICHLOROTETRAFLUOROETHANE

Air-conditioning is a "must" inside bank vaults, museum and library storage rooms and other areas where, for security reasons, there are no windows or little air circulation. Precise control of temperature and humidity also protects important records against atmospheric variations.



Modern baking is a highly mechanized operation—far removed from grandma's oven. In this photo, crackers pour from the delivery end of an automated travelling oven. Air-conditioning is used in large commercial bakeries today to control temperature and humidity and for employee comfort.

It gets pretty hot under a hair dryer—even *with* air-conditioning. And the girls like to enjoy having their hair done. That's why so many beauty parlors are so well air-conditioned. It benefits customers . . . employees . . . *and* owners!

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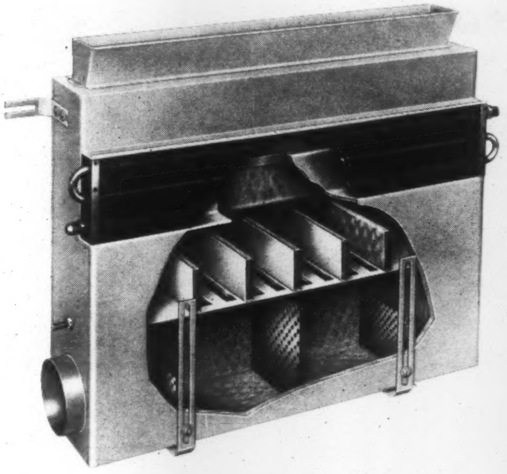

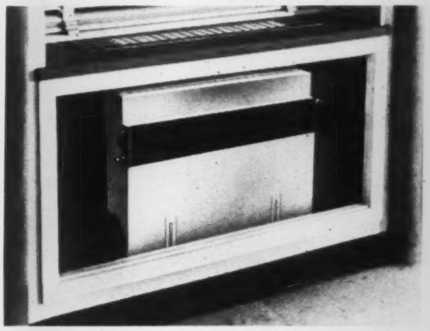

Furred-in arrangement permits custom matching of building architecture. Recirculation grille supplied with frame to facilitate plastering-in. Cabinet enclosures which can be painted to match room décor also available.

New Carrier 37E All-Air Weathermaster

—*only high-velocity terminal with reheat coil!*

Simplicity is the keynote of the new Carrier 37E All-Air Weathermaster*, the only room terminal currently available which provides a reheat coil for high-velocity constant volume single duct systems. These units require no electrical connections, no motors or other moving parts, no filters or condensate drains. And they save valuable building space because they permit the use of compact high-velocity air distribution systems.

Installation is made easy by a choice of right or left hand duct connection, right or left hand connection to the heating coil (steam or hot water, 3 or 5 row), and by the availability of a complete line of accessories for cabinet or furred-in arrangements.

The single duct system with reheat at the unit is acknowledged to be functionally the best possible for maintaining close control of conditions in individual rooms of office buildings, hospitals, hotels, and similar structures, new or old. It is an ideal choice for modernization of a building where the design sensible cooling load is relatively low and where a serviceable steam or hot water heating plant is available.

In addition to the 37E, there's a new Carrier 37D All-Air Weathermaster for double duct systems. For complete information about the new units, call your nearest Carrier office. Or write Carrier Corporation, Syracuse 1, New York.

*Reg. U.S. Pat. Off.

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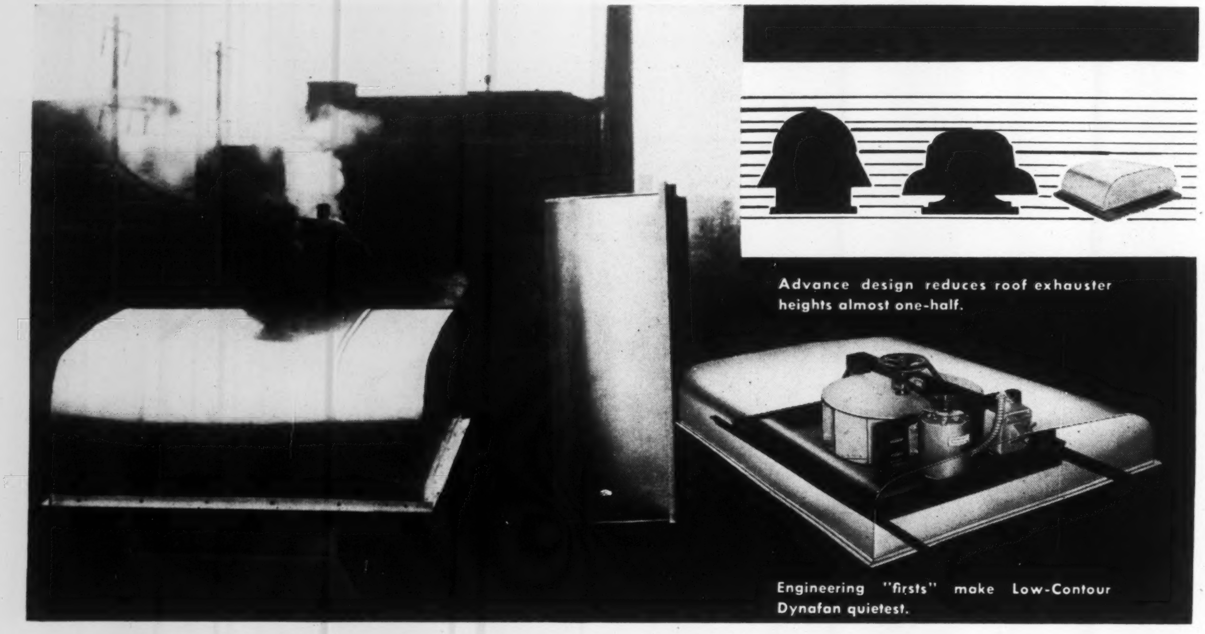
BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

Carrier

LOW...

AND

QUIET



Advance design reduces roof exhauster heights almost one-half.

Engineering "firsts" make Low-Contour Dynafan quietest.

Penn Ventilator's new Low-Contour Dynafan hugs the roofline . . . hardly makes a sound. It's engineered specifically to run quietly. This new unit is your assurance that clean lines designed into modern buildings won't be compromised. Many engineering advances have been incorporated in the Low-Contour Dynafan. For example:

- motor isn't atop the wheel as in most roof exhausters
- there's no vibration-prone overhung shaft
- noise is cut appreciably by straddling
- fan wheels are supported between sealed ball bearings—above and below wheels
- entire fan floats on vibra-sorb vibration eliminators
- exact type motor to fit each particular service condition

Get all the details. Call your Penn Ventilator man or write to Penn Ventilator, Philadelphia.

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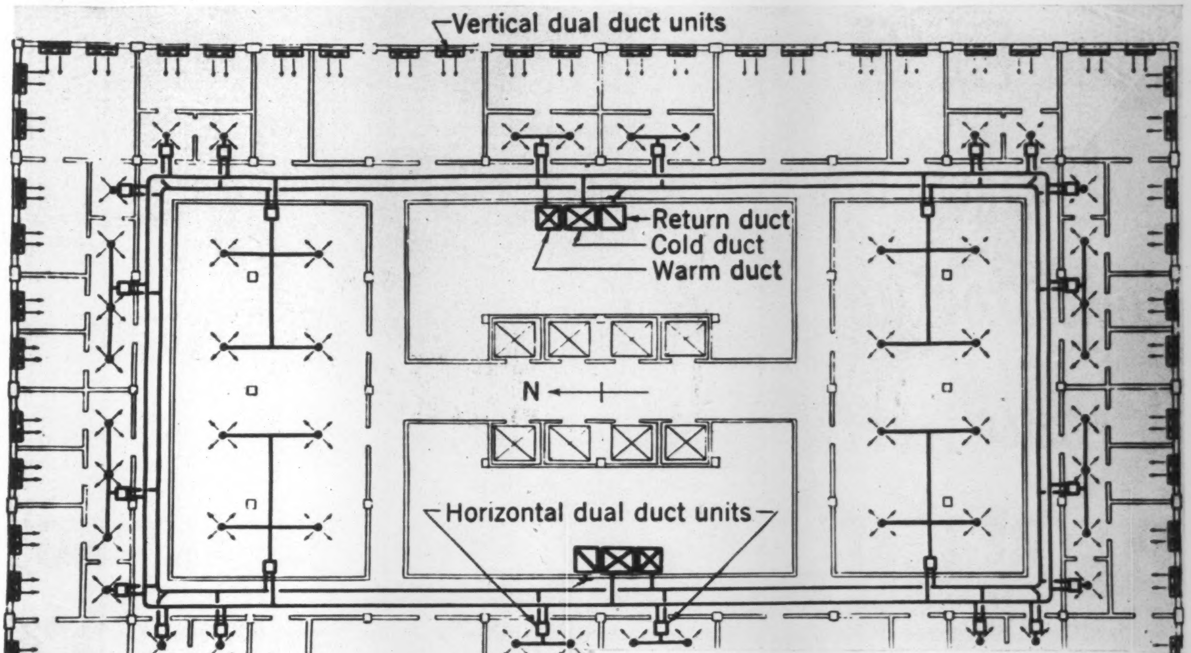
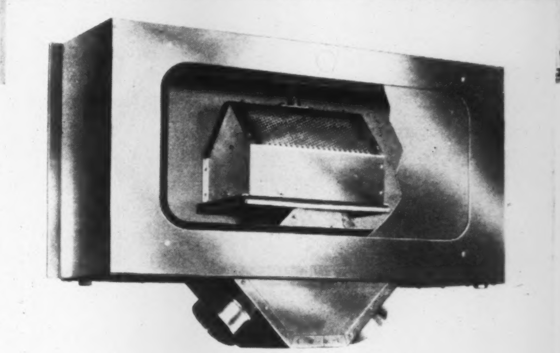
HOW TO "BALANCE A BUILDING" BEFORE IT'S BUILT:





Shown above is a typical office building dual duct layout, 100 per cent air system. It is zoned to provide selective temperature control for each enclosure with Buensod vertical dual duct units at exterior walls. These under-window units may be connected to vertical risers, or to horizontal mains at the ceiling or on the floor below.

Illustrated: Buensod Type V window-wall unit with cut-away showing automatic volume control. This unit is designed for installation under windows to discharge vertically upward, quietly and without draft.

Balancing a building before it's built . . . almost an incongruity, yet Buensod does it consistently. Buensod air mixing units can be pre-set at the factory for desired volume and guaranteed within ±5% when installed. Whenever desired, a change in air volume may be made in the field by simple adjustment of one nut. This practically eliminates the tedious job of balancing after installation . . . a chore which can take months.

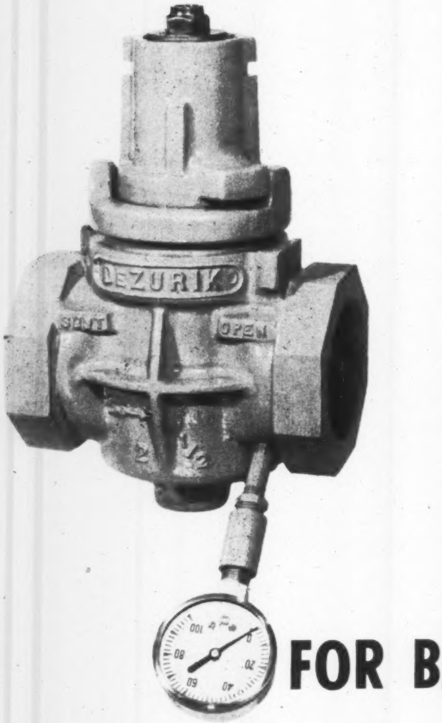
The secret is in Buensod's proven Automatic Volume Control. A simple tent-like apparatus maintains constant air quantity from each unit regardless of variance of static pressures on either inlet or outlet of mixing valve. This operates automatically . . . independent of any outside power source, sensing instrument or complicated linkage arrangement. The mixing valve is actuated by a local thermostat to provide the desired room temperature.

Buensod units are being designed into a constantly increasing number of new and renovated structures. Consider them for your next project.

BUENSOD DUAL-DUCT

Write for details to: BUENSOD-STACEY INCORPORATED **Buensod-Stacey, Inc., 45 West 18 Street, New York 11, New York**

DeZURIK ..the BEST valve for air conditioning because.....



THEY'RE PERFECT FOR BALANCING!

DeZurik Valves have these positive advantages which make them the perfect balancing valves for air conditioning systems:

1. They are furnished with pressure gage connections.
2. They have excellent throttling characteristics.
3. They provide absolute dead-tight, drip-tight shut-off.
4. They require no maintenance.

DeZurik Balancing Valves are furnished with a pressure gage connection on the downstream side of the valve body. This assures a balancing connection at every valve and eliminates the expense of drilling and tapping on the jobsite.

The modified linear characteristic of DeZurik Balancing Valves provides very accurate throttling when the valve is almost closed. With this characteristic — and the visible indication of the plug position — balancing the system is an easier, quicker job.

Exclusive Eccentric Action and a resilient covered plug assure dead tight, drip-tight shut-off. Plug position can be marked when the system is balanced. The valve can then be shut off dead tight to remove a coil or do other maintenance and the system brought back in balance by returning the valve to the previously marked position.

No other valve maintenance is required when DeZurik Balancing Valves are installed. The resilient-faced plug eliminates the need for lubrication. And the rotary stem seal, kept under constant spring tension, will not — can not — leak!

Get more information from the DeZurik representative near you, or write for details.

Available in sizes 1/2" thru 20", in 2-way, 3-way or 4-way models, with manual, on-off or positioning actuators.

DeZURIK
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Only DeZurik Valves give you all these advantages:

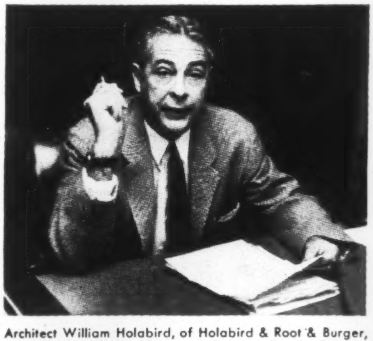
1. Easy Operation
2. Drip Tight Shut-off
3. Low Pressure Drop
4. Best for Balancing
5. Low Installation Cost
6. No Maintenance
7. Proved Record of Dependability
8. Compact Size
9. Economically Priced
10. Versatility beyond compare

ANOTHER
NATIONAL-U.S.
SUCCESS
STORY

NINE MILES OF NATIONAL-U.S. FINTUBE HEATING ELEMENTS USED IN CHICAGO HOUSING PROJECT

Contractors Hill & Ryba, and one of eight buildings comprising Stateway Gardens, new Chicago housing project.

National-U.S. Gas Boilers Also Supply Domestic Hot Water


Architect William Holabird, of Holabird & Root & Burger, the firm which planned Stateway Gardens for the Chicago Housing Authority.

Stateway Gardens, one of Chicago's largest housing developments costing more than $17,000,000.00, provides higher living standards for approximately eight thousand residents of the 1,644 dwelling units in its six 17-story, and two 10-story buildings.

Heating for all eight is supplied through National-U.S. convector-type radiators—more than 47,000 linear feet of fin tube units enclosed in 66,000 linear feet of National-U.S. slope-top enclosures.

Hot water for faucet, laundry and general use is provided by seventeen National-U.S. "66" Series Cast Iron Gas Boilers.

The bulk of the installation was handled by H. P. Reger & Co.; one of the major firms dealing in plumbing, heating and air conditioning in the Chicago area. M. J. Holleran, Inc., one of Chicago's top five mechanical contractors, equipped two of the 17-story buildings.

Says Joseph W. Ryba, coordinator for the Reger Company, "One of the good features of working with the National-U.S. Radiator Fintube Units is that we were able to install a double row of the units in rooms which are unusually large, or which are subjected to more severe conditions than others. This doubling up is done at practically no sacrifice in space, either."

More than 66,000 feet of this National-U.S. Slope Top enclosure covers National-U.S. Fintube Radiators throughout the entire projects.

Seventeen of these "66" Series Gas Boilers by National-U.S. assure ample domestic hot water for the families living in the 1,644 dwelling units.

Another advantage in using National-U.S. equipment is cited by Warren E. Hill, Vice-President of M. J. Holleran, Inc.

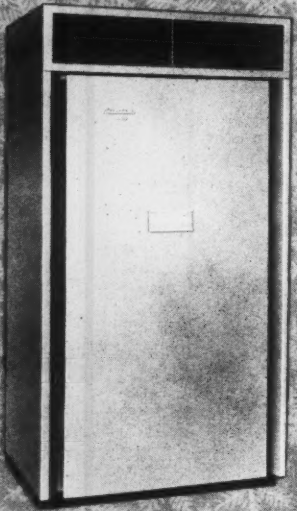
"We have found National-U.S. representatives thoroughly cooperative in all our dealings with them," he stated.

Full details on the equipment used in this important project are available. Inquire at our nearest office—see the yellow pages of your phone book—or write:

National-U.S. Radiator
CORPORATION
HEATING AND AIR CONDITIONING DIVISION
Johnstown, Pennsylvania

Curtis

CONDITIONS COMMERCIAL AMERICA...



Curtis packaged units minimize floor area required. Factory assembled and tested. Field installation requires only setting and connecting utilities.

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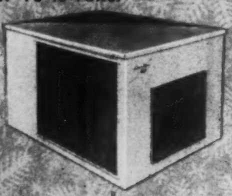

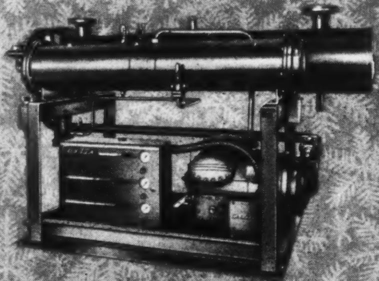

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close tolerance manufacturing, builds peak performance into every CURTIS unit.

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Yet Curtis prices are right in line.

This is why Curtis designs and builds thousands of unique air conditioning systems for commercial America . . . why Curtis is able to maintain a family of over 300 representatives and servicing contractors across the nation.

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OUR 105th YEAR

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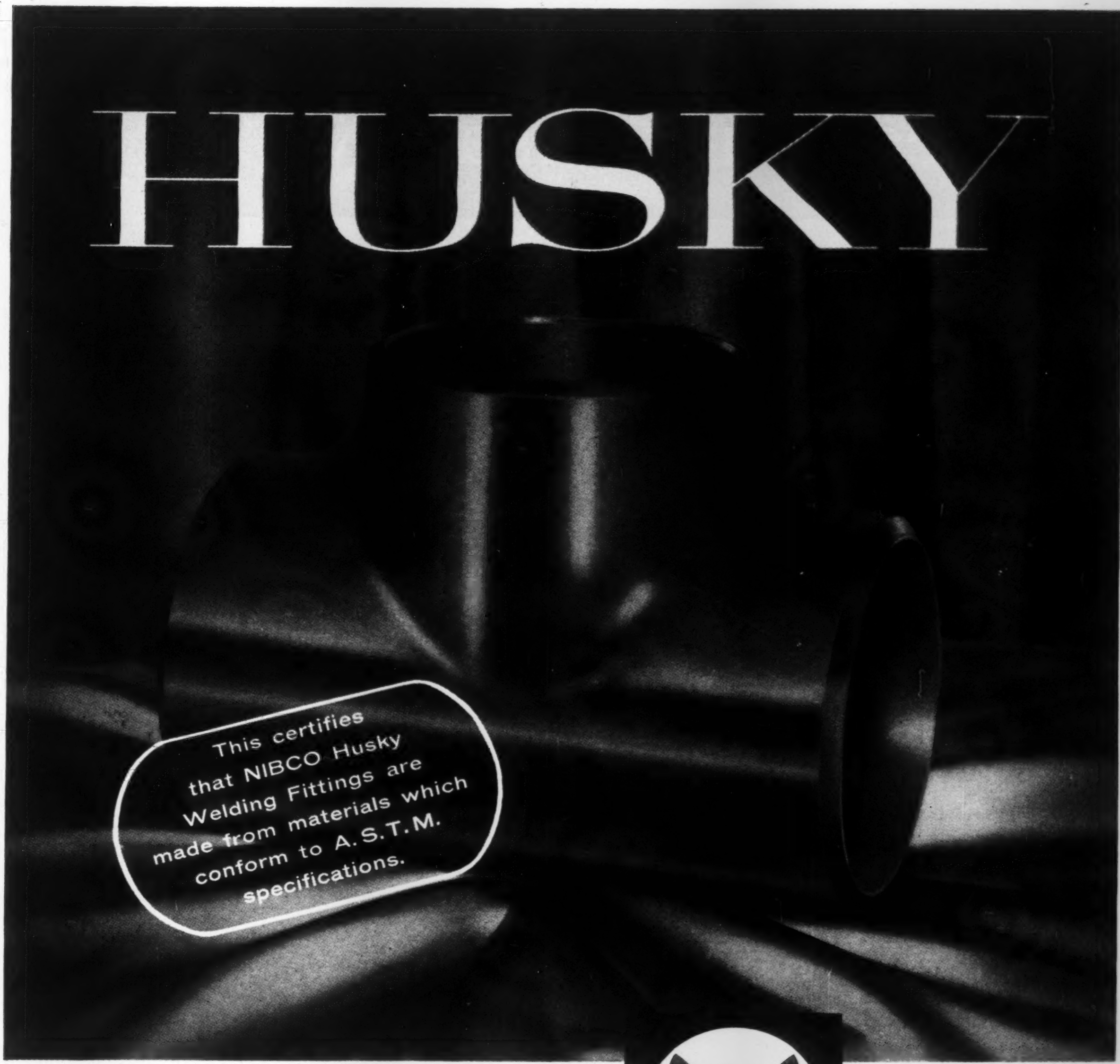
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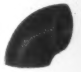
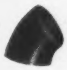

90° elbows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1¼ SCR	2,700	50	51.0	1,370
1½ SCR	4,000	50	75.6	1,840
2 SCR	8,000	25	151.0	3,570
2½ SCR	12,900	15	244.0	4,500
3 SCR	17,000	15	320.0	6,600
4 FLG	27,000	8	510.0	8,900
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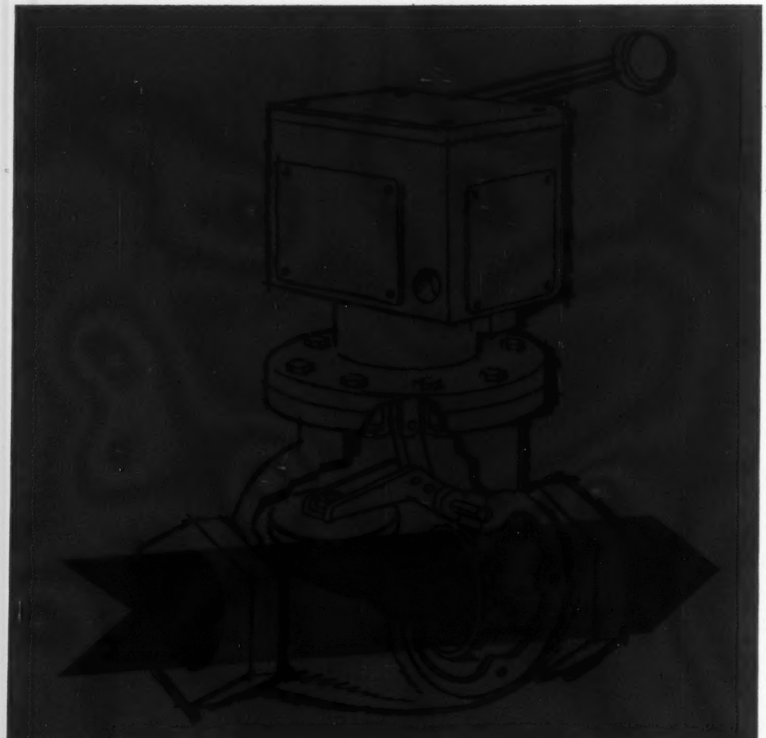

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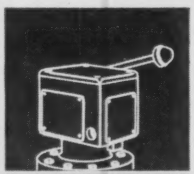
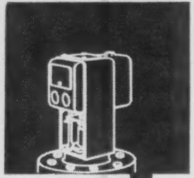


V-116 MANUAL RESET, with lever action—90° handle travel. Held open electrically, spring closed on power interruption.



H-117 HYDRAMOTOR, electric reset, with either fixed opening speed or adjustable opening speed regulated to design of equipment.

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Straight through flow provides high capacity... minimum pressure drop. And you get an unequalled combination of safety characteristics. *Spring-loaded* inner valve closes with pressure for positive safety shut-off. Direct in-line action without complicated linkage. *Rubber-faced* vertical seating won't scratch or score... assures *tight shut-off. Dual release actuator* assures positive closing. Fixed or adjustable opening speeds for specific duty. Line sizes from 1" to 6" pipe. Costs less than valves that can't measure up in quality, performance or adaptability. Check the capacity table... then check the valve out with your nearest General Controls representative.”

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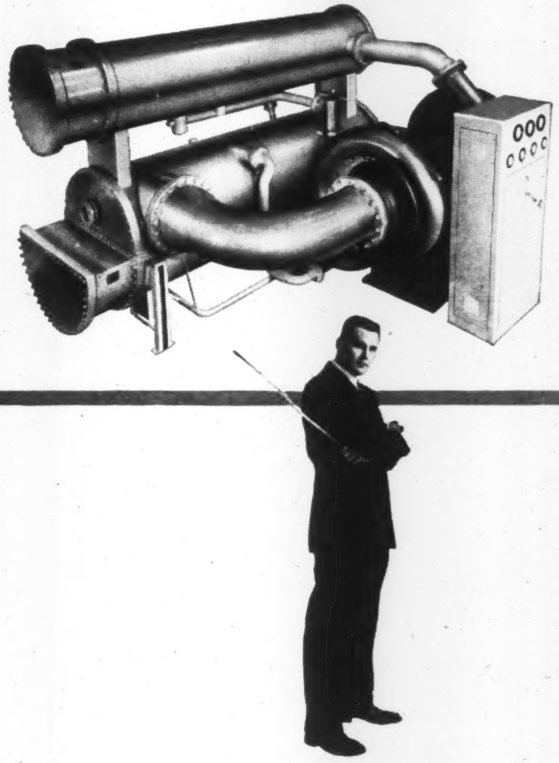
. . . most versanomical way to air condition anything!

Versanomical—that's the word for Chrysler's Centrifugal Water Chiller. It's versatile: engineered for any air conditioning project from 125 hp to the largest. And economical: packed with special engineering features that cut operating and service costs. For example:



① **True volute casing.** A Chrysler design exclusive that minimizes refrigerant turbulence . . . reducing horsepower load on the motor.

② **Adjustable guide vanes.** Unique airfoil design employs new principles to increase compressor efficiency to the maximum while maintaining operating stability.

③ **Automatic operation.** Factory-assembled control console including all required safety controls, indicator lights and gauges.

④ **Automatic purger.** Removes non-condensable gases and water vapor. Prevents contamination of refrigerant system, cuts service costs.

⑤ **Interlocked lubrication.** System protects motor bearings with a constant flow of oil. Compressor can't run unless oil pump operates.

Chrysler Centrifugal Water Chillers are factory pre-tested under simulated operating conditions to assure peak performance. Get complete engineering data and technical assistance from your local Chrysler Applied Machinery and Systems sales office. Or write: Airtemp Division, Chrysler Corporation, Dept. Y-59, Dayton 1, Ohio.

CHRYSLER
AIRTEMP

FIRST WITH THE FINEST IN AIR CONDITIONING

For the first time!

Everything you need in Dial Thermometers for Piping *and* Duct work!

A new and complete line of instruments: Dial thermometer of Marsh precision and accuracy designed down to the last detail for piping and duct work . . . for use on heating and cooling equipment, air ducts, vessels and kilns, ovens and similar applications.

Easier to read

Illustrations tell the story. Four types, seven ranges—72 stock combinations to meet every condition. Big, legible 3½" and 4½" dials . . . easy to read in places where piping and duct thermometers must be installed. Ease of reading further increased by provision for tilting and turning dials to any desired reading angle. Line includes distant reading types that take care of remote locations.

Unbreakable—more accurate

Instead of fragile difficult-to-read glass tube thermometers you now have sturdy, unbreakable, legible Marsh Dial Thermometers. Guaranteed accurate to plus or minus one division of the scale, they have far greater *readable* accuracy than any glass tube type. All have the famous Marsh "Recalibrator"—to *keep* them accurate.

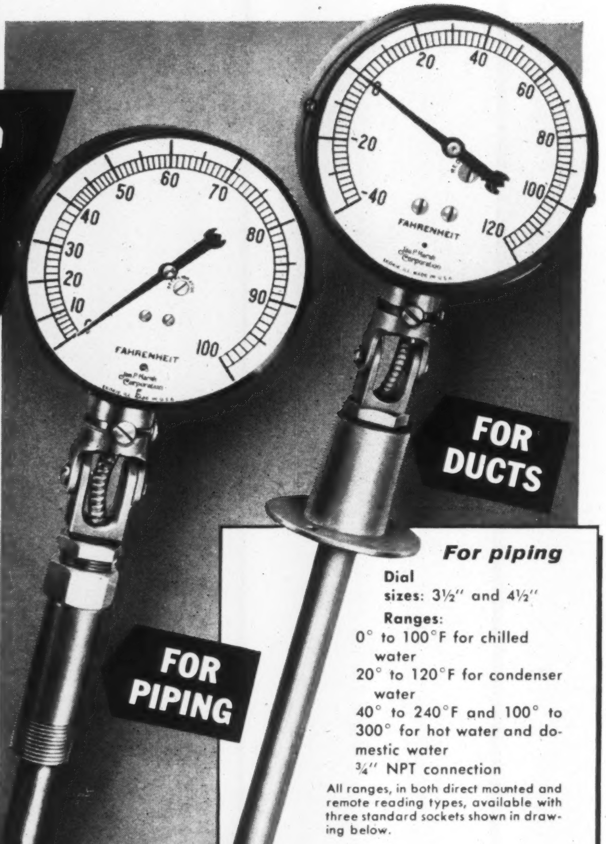
All purpose

Design provides for every on-the-job condition. Separable sockets ("wells") simplify installation—or removal for servicing. Extension necks take care of insulation on piping or ducts. Long stems in duct type put temperature-sensitive section where it belongs.

Note the brief specifications opposite. Any thermometer is available from stock.

Write for bulletin telling the whole story.

Jas. P. Marsh Corporation
Dept. T, Skokie, Ill.
Marsh Instrument & Valve Co. (Canada) Ltd.
8407 103rd Street, Edmonton, Alberta

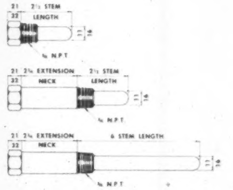


For piping

Dial sizes: 3½" and 4½"

Ranges:
0° to 100°F for chilled water
20° to 120°F for condenser water
40° to 240°F and 100° to 300° for hot water and domestic water
¾" NPT connection

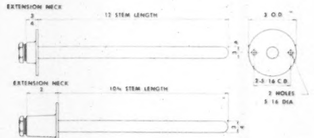
All ranges, in both direct mounted and remote reading types, available with three standard sockets shown in drawing below.

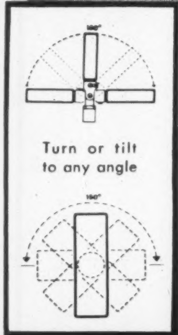


For ducts

Dial sizes: 3½" and 4½"
Ranges: —40° to +120° F
0° to 160° F
0° to 220° F

All ranges, in both direct mounted and remote reading types, available with standard extension necks and stems shown in drawing below.

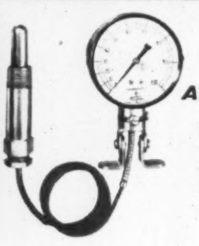




Turn or tilt to any angle

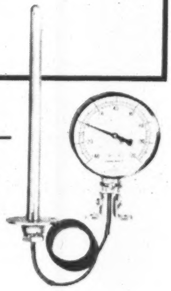
MARSH

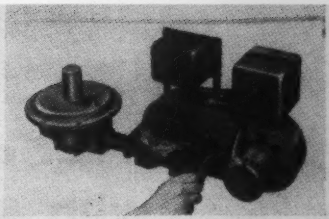
DIAL THERMOMETERS



Also remote reading—

Piping and duct thermometers of same basic design available with 6 ft. of capillary tubing as shown.

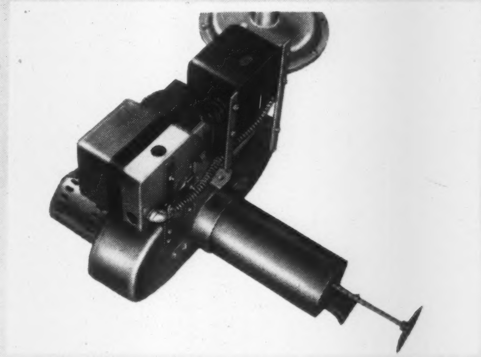




THE Nu-Way CORPORATION
Heating Equipment
Rock Island, Illinois

INTRODUCES 2 MORE POWER GAS BURNERS

MODEL G-750
MODEL G-1000



Both Model G-750 (input to 750,000 BTU/hr.) and Model G-1000 (input to a million BTU/-hr.) can be installed in any boiler or furnace design, with horizontal, revertible flue, or in any unit originally designed to be fired with power equipment. Both can also be custom-engineered by Nu-Way to a particular unit if desired. Both are available in 3 models with choice of 1) thermoelectric-type pilot safety with flash tube ignition of standing-type pilot; 2) electronic pilot safety and flash tube ignition of standing-type pilot; or 3) electronic pilot safety with prepurge and electric, spark-ignited intermittent pilot. Compact, slim-trim design. Panel construction insures quick servicing. Write Dept. HP-559, The Nu-Way Corporation, Rock Island, Ill. for details.

. . . WITH ON-THE-JOB PRIMARY AND SECONDARY AIR ADJUSTMENT

Dual control of combustion air makes it possible for these Nu-Way burners to be installed *and then* adapted to the conditions of the particular unit being fired. This insures extremely quiet operation and permits setting the burner for units with either low or high static drop through the flue passes.

ALSO ASK US ABOUT
Sundstrand
ALL-ELECTRIC BURNERS

UP TO 1,000,000 BTU/HR

Perfect air diffusion for electronic computers with ANEMOSTAT AIR DIFFUSERS

High heat return from computer equipment and from high intensity lighting is efficiently controlled by air diffused through scientifically designed Anemostat Air Diffusers.

Anemostat Air Diffusers change the air in a room *once every minute* without a draft. As a result, equipment and technicians operate at peak efficiency in this comfortable thermal environment.

Write for your copy of ANEMOSTAT Selection Manual 60 which contains data on the wide-range ANEMOSTAT line.

ANEMOSTAT®

DRAFTLESS *Aspirating* **AIR DIFFUSERS**
ANEMOSTAT CORPORATION OF AMERICA
10 East 39th Street, New York 16, N. Y.
Representatives in Principal Cities

Industry Standard for Lower Maintenance Costs

LQ600®

Here's Why: Long accepted valve maintenance costs are a thing of the past in thousands of plants where LQ600's have been installed . . . even in the most severe services where previous valves required repair or replacement after as little as two weeks on the line.

These outstanding savings are made possible by seats and discs of Brinalloy®, a patented Lunkenheimer alloy that is more resistant to wear and corrosion than 500 Brinell Stainless or 1000 Brinell Case-Hardened Stainless Steel.

Add to this the Lunkenheimer exclusive silicon-bronze Stemalloy®, the most durable stem material ever put into a valve, and you have two important reasons why LQ600's have established new low-maintenance standards everywhere they are installed.

For an actual comparison test, call the Lunkenheimer Distributor in your area. He is an expert on valve maintenance costs and will be glad to demonstrate the maintenance-saving benefits you receive when you install LQ600's . . . or write The Lunkenheimer Company, Cincinnati 14, Ohio

LQ600-150 150 lb. S.P., 300 lb. W.O.G.

LQ600-200 200 lb. S.P. 550°F., 400 lb., W.O.G.

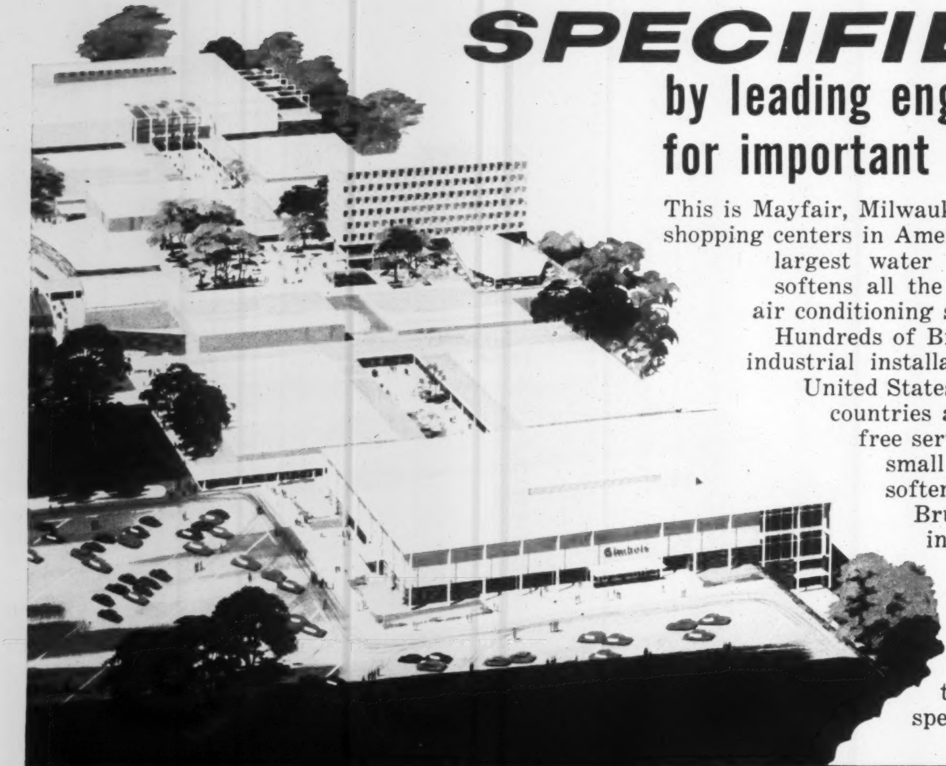
LUNKENHEIMER QUALITY®

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

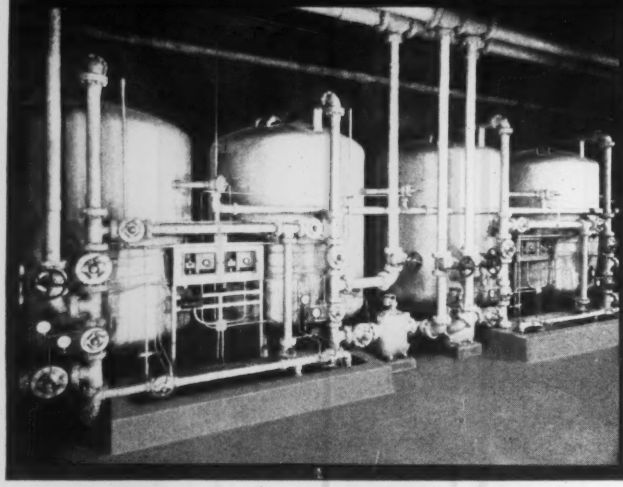
BRUNER Industrial WATER SOFTENERS

. . . are frequently SPECIFIED by leading engineers for important installations



This is Mayfair, Milwaukee, one of the largest shopping centers in America. One of Bruner's largest water softener installations softens all the water — even in the air conditioning system.

Hundreds of Bruner commercial and industrial installations throughout the United States and in many foreign countries are providing trouble-free service in both large and small applications. Water softeners, filters, and other Bruner water conditioning equipment are available for immediate delivery from stock in many types and sizes. Custom installations are fabricated to engineer's exact specifications.

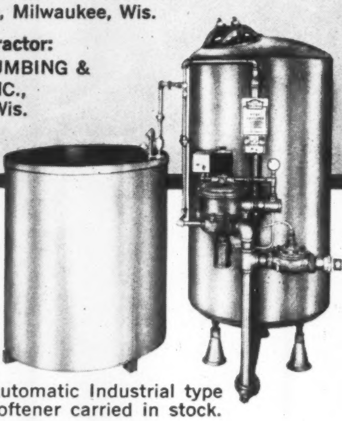


The Bruner softeners at Mayfair are fully automatic. Salt storage and brining systems are specially designed. Softener capacity is 13,000,000 grains and delivers 1,750,000 gallons of softened water @ 1200 GPM.

Consulting Engineer: L. R. SCHMAUS CO., INC., Milwaukee, Wis.

Architect: GRASSOLD-JOHNSON & ASSOCIATES, Milwaukee, Wis.

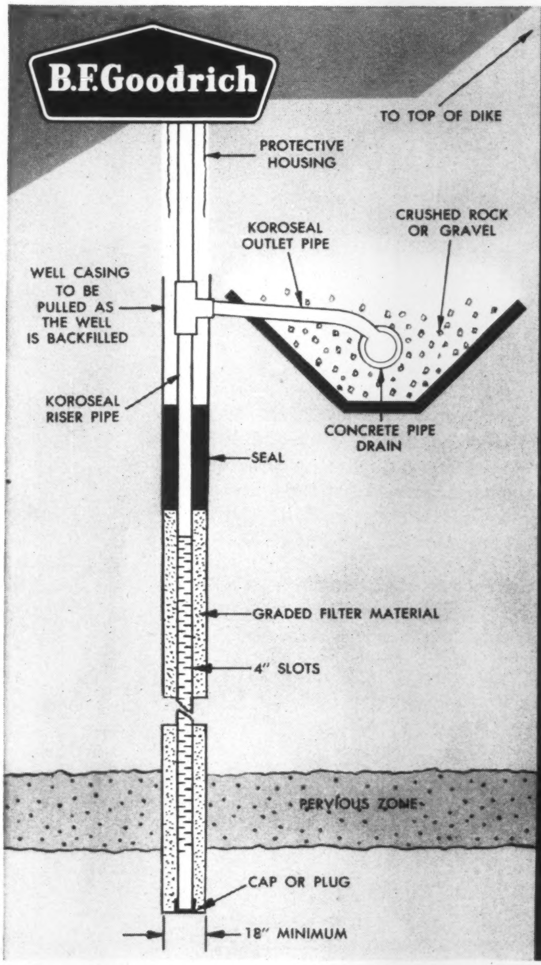
Plumbing Contractor:
SEDLET PLUMBING & HEATING, INC.,
Milwaukee, Wis.



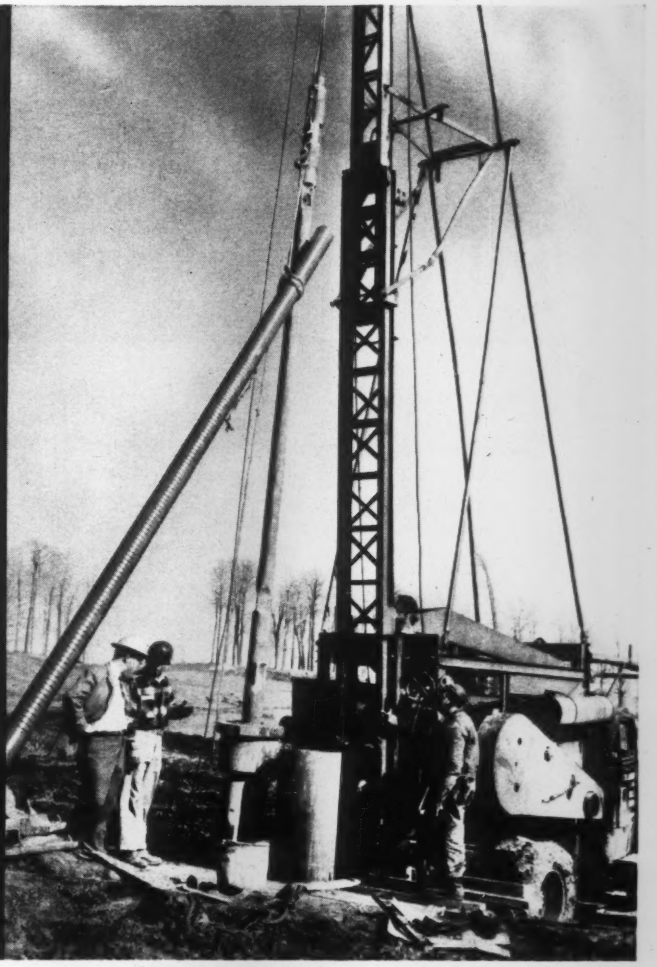
Automatic Industrial type softener carried in stock.

BRUNER
WATER SOFTENERS & FILTERS

BRUNER CORPORATION
America's most complete line of quality water softeners and filters.
Executive Offices: 4763 N. 32nd ST., MILWAUKEE 9, WIS.
Telephone: HIlltop 2-3200
Plants: Milwaukee, Wis., and Los Angeles, Calif.
Sales and Engineering Offices in all principal cities.


B.F.Goodrich
TO TOP OF DIKE
PROTECTIVE HOUSING
KOROSEAL OUTLET PIPE
CRUSHED ROCK OR GRAVEL
WELL CASING TO BE PULLED AS THE WELL IS BACKFILLED
KOROSEAL RISER PIPE
CONCRETE PIPE DRAIN
SEAL
GRADED FILTER MATERIAL
4" SLOTS
PERVIOUS ZONE
CAP OR PLUG
18" MINIMUM

Koroseal PVC pipe relieves hydrostatic pressures under the toe of dikes built along the St. Lawrence Seaway from Waddington, N. Y. to Massena, N. Y. Underground water enters the Koroseal riser pipe through a series of slots. Under pressure, water rises inside pipe and is discharged through Koroseal drainage pipe to natural drainage channels.



Twenty-foot length of B.F.Goodrich rigid Koroseal PVC slotted pipe swings into position for sinking as a relief well. More than 2,000 feet of this Koroseal pipe, known for its resistance to corrosion, taps "pervious zones" beneath dikes and draws off underground water that might otherwise weaken the structures.

B.F.Goodrich Koroseal PVC pipe protects dike system on St. Lawrence Seaway

WHEN gates of the new Long Sault dam and St. Lawrence power dam were closed, a lake extending 35 miles upstream was formed. Dikes, some as high as 85 feet, were built to safeguard the surrounding countryside, including some populated areas which were 40 feet below the lake level.

To protect against excess hydrostatic pressures along the dike toe, 23 relief wells of 6-inch B.F.Goodrich Koroseal PVC pipe were installed to serve as automatic safety valves. These Koroseal relief wells tap "pervious zones" 20 to 50 feet beneath the dikes and draw off underground water that might otherwise undermine embankments.

In this installation, engineers specified Koroseal PVC pipe because of its superior resistance to corrosion and its strength. Koroseal also has high impact resistance and superior insulation qualities. It threads easily, can be cut, welded or drilled. It never needs to be painted, will not support combustion. Koroseal is available in pipe, tubes, rods, valves and sheets. For information, just send in the coupon.

B.F.Goodrich Industrial Products Co.
Dept. HP-5, Marietta, Ohio
Please send me free booklets on:
☐ Rigid Koroseal Pipe
☐ Rigid Koroseal Sheet

Name________________

Company________________

City________ Zone____ State______

Koroseal—T. M. Reg. U. S. Pat. Off.

Koroseal pipe slotted and sold by F. C. Nichols, Inc., Norwood, Syracuse and Niagara Falls, New York.

B.F.Goodrich ***Koroseal rigid PVC products***

You get these benefits when you install YARWAY GUN-PAKT EXPANSION JOINTS

Why do industrial plants, institutions, universities and central heating plants SPECIFY and INSTALL Yarway Gun-Pakt Expansion Joints?

Because with Yarway you get:

- **CONTINUOUS SERVICE**
  Costly shutdowns are eliminated. Packing is seldom necessary but may be added *under full line pressure.* No vents are necessary. Never needs repacking.
- **RUGGED DEPENDABILITY ALL STEEL CONSTRUCTION**
  Durable chromium plated seamless steel sleeves. No chance *of metal fatigue.* Wrought steel bases provide rugged, positive anchorage.
- **INTERNAL AND EXTERNAL GUIDES**
  Positive alignment of sleeve in stuffing box —*where it counts!*
- **LIGHT WEIGHT, STREAMLINED DESIGN**
  Requires less space to install—less space to maintain—smaller manholes.

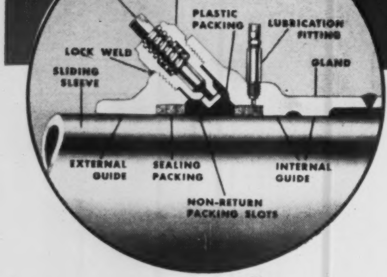
Many Gun-Pakt joints have been *in service over 25 years with only nominal maintenance*—no major repairs or periodic overhauls. Maintenance costs are negligible—records show average to be one manhour and 65 cents worth of packing per joint per year. AND—NEVER A SHUTDOWN FOR REPACKING!

YARWAY field engineers are qualified to advise on installation and service—at no cost to you. Investigate today. Write for Bulletin EJ 1917 ('59).

FOR YOUR NEXT PIPELINE JOB—BE SAFE—BE SURE! SPECIFY YARWAY GUN-PAKT.

YARNALL-WARING COMPANY
107 Mermaid Avenue, Philadelphia 18, Pa.
BRANCH OFFICES IN PRINCIPAL CITIES

10" Yarway Type W Gun-Pakt double-end joint with welding ends, 4 guns each end.



Cross-section of Gun-Pakt feature. To add packing, just insert a plug and turn the plunger. Note non-return packing slots.

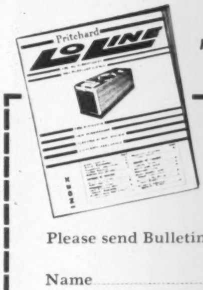
YARWAY GUN-PAKT

Can you find the Pritchard LoLine cooling tower in this picture?

Chances are it will take more than a cursory glance to spot the Pritchard LoLine Cooling Tower in the picture. That's because it is low . . . hugs the roof inconspicuously . . . becomes almost a *part* of the building. It is particularly suited for use where architectural considerations are important.

Yet the Pritchard LoLine tower is a workhorse. Its sleek appearance takes nothing away from its performance. Available in capacities of 75 tons and up, it will handle most commercial and industrial cooling requirements with ease. Initial, operating, and maintenance costs are low, too.

So whether your main concern is aesthetics or performance, air conditioning or process cooling, commercial use or industrial use, there is a Pritchard cooling tower that will fit your needs to a "T."



For full information on Pritchard LoLine Cooling Towers, send coupon for informative 16-page bulletin.

J. F. PRITCHARD & CO.
OF CALIFORNIA
Dept. 123,
4625 Roanoke Pky., Kansas City 12, Mo.

Please send Bulletin 5.1.902 on LoLine Cooling Towers

Name .... Title ....

Firm ....

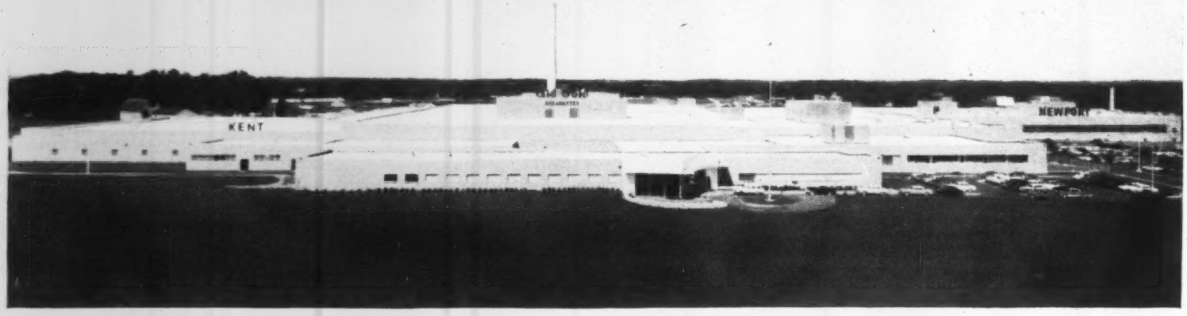
Address ....

City .... Zone ...... State ....

KENT
CIGARETTES
NEW
EXCLUSIVE MICRONITE FILTER

Planning that looked far ahead

P. LORILLARD COMPANY'S award-winning plant



This plant covering over 600,000 sq. ft. produces famous Old Gold, Kent and Newport cigarettes in a completely automated process. Its most modern "climate control" involves refrigeration capacity equal to 120,000,000 lbs. of ice per year.

Architect and Engineer:
Lockwood Greene Engineers Inc., New York, N. Y.
General Contractor:
H. L. Coble Construction Company, Greensboro, N. C.
Air-conditioning Contractor:
Buensod-Stacey, Inc., New York, N. Y.
Piping Contractor:
Grinnell Company, Charlotte, N. C.
Plumbing Contractor:
Dixon & Christopher, Inc., Greensboro, N. C.

equipped throughout with JENKINS VALVES

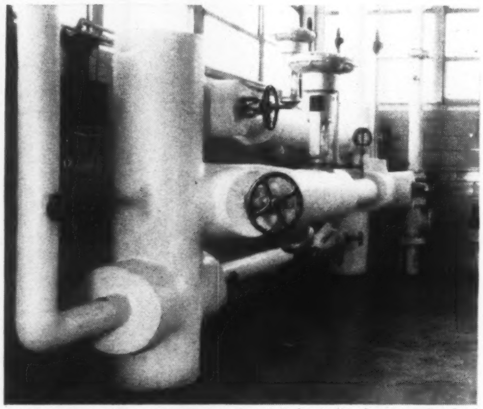
One of the ten "Top Plants of 1956*", the Lorillard plant at Greensboro, N. C. is notable from any standpoint but especially for planning that looked far ahead.

You see it everywhere. In exterior surfaces of brick, aluminum and marble that need almost no maintenance. In walls of glazed tile and floors that are concrete or hard surfaced to reduce cleaning.

You see it in the standardization on Jenkins Valves to assure that costly valve maintenance and replacement will not develop in future years.

To plant and building owners and the experienced men who design and construct for them, the specification "JENKINS" has been an unquestionable assurance for almost a century. You will want to have this assurance of long, trouble-free service when you specify or install valves, especially since Jenkins Valves cost no more. Jenkins Bros., 100 Park Ave., New York 17.

Sold Through Leading Distributors Everywhere



Jenkins bronze, iron, cast steel and stainless steel valves are standard in this modern plant. Shown is a typical installation on the main water supply line.

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
JENKINS ®
SINCE 1864
Jenkins Bros

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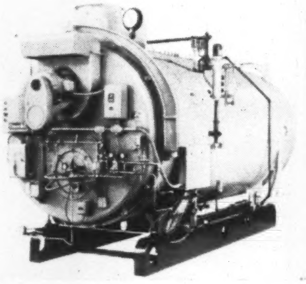
*As selected by a leading business publication

EQUIPMENT DEVELOPMENTS....

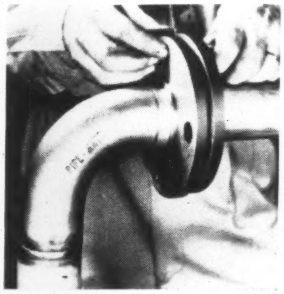
For reviews of Recent Trade Literature see page 244



Packaged Boilers . . .

. . .designed for heating, processing steam, or hot water for commercial, industrial, institutional applications —*Cleaver-Brooks Co., Dept. HPAC, 326 E. Keefe Ave., Milwaukee* 12.

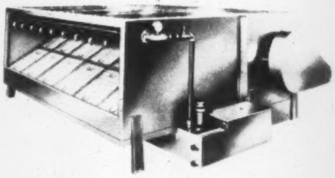
Packaged fire tube boilers now include units in 400, 500, 600 hp sizes. Line now available in range from 15 to 600 hp with 18 sizes in 90 models. Provided for high or low pressure steam and can be fired with oil, gas, or combination oil-gas.



Stainless Fittings . . .

. . .designed for nominal temperature, low pressure non-critical process piping—*Tube Turns, Div. of Chemetron Corp., Dept. HPAC, 224 E. Broadway, Louisville* 1.

New "Pipe-Mate" line of stainless fittings available in sizes ½ through 4 in. "Schedule 5S" and "Schedule 10S" fabricated in stainless steel grades best suited to corrosive applications at 150 psi or less. Features cited include: swivel-type insert flange designed for ease of alignment; "Plug-R-Cap" reversible cap and plug fitting. Fittings can be butt-welded. Line includes expanders, alignment connectors, 45 and 90 deg elbows, returns, eccentric and concentric reducers, tees and crosses, reducing tees, caps, stub ends, flared nipples and flanges.



Air Conditioning Units . . .

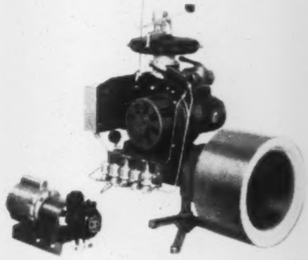
. . .in expanded line including high pressure models and capillary conditioners—*American-Standard, Industrial Div., Dept. HPAC, Detroit* 32.

Central station air conditioning units are factory assembled. Recommended for static pressures from ¼ in. to 9 in. WG, and deliveries from 800 to 40,000 cfm. Four types available: "Type A" conditioner for summer cooling and dehumidifying and winter heating; "Type S" sprayed coil conditioner; "Type AB" multi-zone conditioner for application in multiple zone areas; "Type C" capillary conditioner.

Packaged Liquid Chiller

. . .designed for school applications —*American Air Filter Co., Inc., Dept. HPAC,* 215 *Central Ave., Louisville* 8.

Circulating water chiller of "Herman Nelson" line is of shell and coil type, glass fiber insulated. Internally finned tubes said to greatly increase coefficient of heat transfer on refrigerant side without increase in pressure drop. Ten models available ranging from 20 to 120 hp. Depending on entering and leaving water temperatures, capacities range from 15 to 166 tons. Hermetically sealed compressors available in 20 through 60 ton sizes.



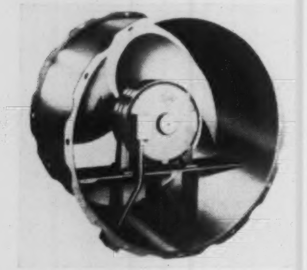
Oil Burner . . .

. . .developed for use on scotch marine boilers where there is known or possible back pressure or positive furnace pressure—*Mettler Co., Inc., Div. of Eclipse Engineering Co., Dept. HPAC,* 1101 *Buchanan St., Rockford, Ill.*

"Turbo-Flame" burners available in five standard models ranging in capacity from 1 to 5 million Btu per hr. Burner capacity determined by back pressure developed in furnace. Straight gas, straight oil, or gas-oil combination burners available in all five basic models; gas dual-fuel burners also available. Burner's gas pilot is spark ignited by 6000 volt transformer on straight gas and combination gas-oil burner operation. Gas pilot required when burning oil.

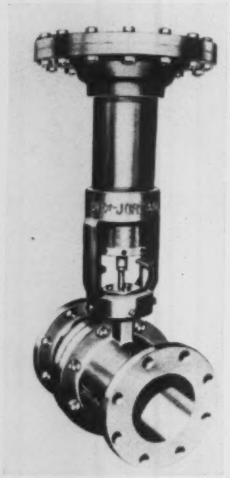
Duct Fan . . .

. . .to be installed as section of duct —*Ilg Electric Ventilating Co., Dept.*



HPAC, 2850 N. Pulaski Rd., Chicago 41.

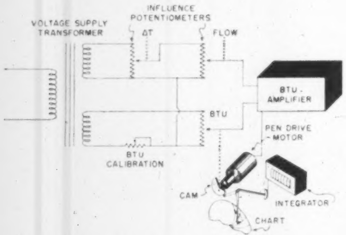
Newly designed duct fan available in 16 sizes ranging in capacity from 1040 to 21,200 cfm at static pressures to 1½ in. WG. Unit can be mounted in any position, according to manufacturer. Smaller sizes have three blade propeller; larger sizes, a five blade propeller. Fan unit mounted in welded steel housing with flanged ends forming prefabricated fan and duct section.



Pressure Reducing Valves

. . . designed to provide tight shutoff, accurate control, minimize maintenance—*Jordan Corp., Div. of OPW Corp., Dept. HPAC, 6013 Wiehe Rd., Cincinnati 13.*

Pilot operated pressure reducing valves with sliding gate and plate seats available in 4 and 6 in. sizes. Valves capable of handling 50,000 lb per hr of steam, 2300 gpm of water or 15,000 cfm of air. Suitable for pressures to 125 psi and temperatures to 406 F. Main valve cast iron with 125 lb ASA flanges, pilot valve cast iron with screwed ends. Product described in two bulletins: "SRB 11-59," "J-170."



Btu Meter . . .

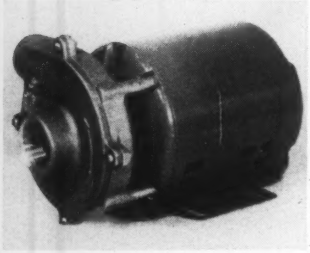
. . . designed for use in measuring heat transfer in hot water generators, cooling towers, air conditioning systems—*Hays Corp., Dept. HPAC, 800 E. Eighth St., Michigan City, Ind.*

"Model 913" Btu meter is single instrument to record, indicate, integrate Btu loss or gain in flowing liquid. Temperature differential, flow rate of liquid also recorded. Two platinum resistance temperature elements, differential connected and measuring inlet and outlet temperature of the liquid, form two legs of resistance bridge.

Gas Fired Boilers . . .

. . . developed for commercial, industrial uses—*H. C. Little Burner Co., Inc., Dept. HPAC, Dubois and Woodland Ave., San Rafael, Calif.*

Boiler has draft hood with vertical to horizontal design, sealed aluminized steel flue-collector. Staggered fins on sides of sections intended to provide maximum heat transfer area for hot flue gases.



Centrifugal Pump . . .

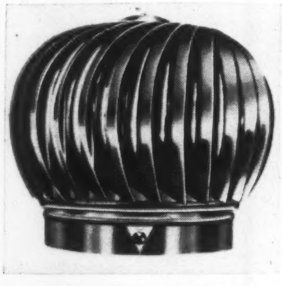
. . . designed for small cooling tower and chilled water applications—*Triangle Mfg. Co., Dept. HPAC, 7535 W. Eight Mile Rd., Detroit 21.*

Direct connected centrifugal pump available with either ¼ or 1/3 hp, 3450 rpm, 110 or 220 volt, 60 cycle, 1 phase motors with rubber mounted base and built-in thermal protection. Pump has 1¼ in. FPT suction and 1 in. FPT discharge connection. Larger-motored pump varies from 40 gpm of water at 22 ft head to 2½ gpm at 34 ft head.

Thickness Tester . . .

. . . in lightweight, self-contained design—*Branson Instruments, Inc., Dept. HPAC, 40 Brown House Rd., Stamford, Conn.*

"Audigage Model 6" ultrasonic thickness tester, including batteries, probe, harness, cable, earphones, weighs less than 5 lb. Recommended by manufacturer for field inspection of corrosion in piping, tanks, pressure vessels, similar equipment. Instrument range is 0.09 to 5 in.; accurate from 3 to 5 percent. For use on any flat, cylindrical, compound-curved surface down to 1 in. radius.



Rotary Roof Ventilator . . .

. . . with ball bearing suspension designed reduce friction losses—*Western Engineering & Mfg. Co., Dept. HPAC, 4114 Glencoe Ave., Venice, Calif.*

Rotary roof ventilator has totally enclosed, wool packed lubricant reservoir. Support assembly includes rubber isolation mountings.

How **B&W JOB-MATCHED TUBING** saves in oil heater applications

. . . A complete range of carbon, alloy and stainless steels—permits choice of steel to match service conditions.

. . . A wide size range—provides for freedom of design.

. . . Uniform dimensions and mechanical properties — helps to provide ease of fabrication.

These are just a few of the reasons it pays to specify B&W Job-Matched Seamless Pressure Tubing. Call the tubing specialist at your local B&W District Sales Office, or write for Bulletin TB-417 for full information. The Babcock & Wilcox Company, Tubular Products Division, Beaver Falls, Pennsylvania.

B&W THE BABCOCK & WILCOX COMPANY

TUBULAR PRODUCTS DIVISION

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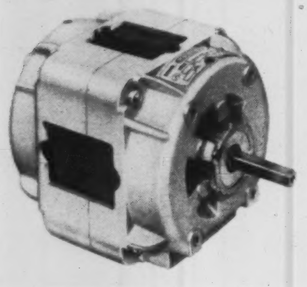
Seamless and welded tubular products, solid extrusions, seamless welding fittings and forged steel flanges—in carbon, alloy and stainless steels and special metals

EQUIPMENT DEVELOPMENTS

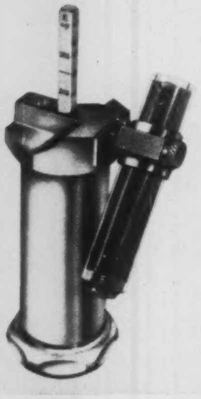
Continued



Induction Motor . . .

. . . in small frame design—*Howard Industries, Inc., Dept. HPAC,* 1760 *State St., Racine, Wis.*

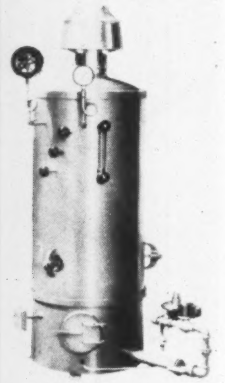
New "Model 9200" induction motor has low level magnetic hum, reduced external magnetic field, low temperature rise, minimum cogging, hunting, according to manufacturer. Frame size is $2\frac{7}{8} \times 2\frac{7}{8}$ in. with overall length of 4 1/32 in. for frame "9210" and 4 13/32 for frame "9214." Unit is permanent split capacitor, single phase, 50/60 cycle motor available in induction, torque, types; also available in 2 or 3 phase designs. Horsepower ratings are from 1/300 to 1/30 hp.



Fuel Oil Preheat Indicator

. . . designed to indicate temperature to which No. 6 fuel oil must be preheated for best atomization viscosity —*Bacharach Industrial Instrument Co., Dept. HPAC,* 200 *N. Braddock Ave., Pittsburgh* 8.

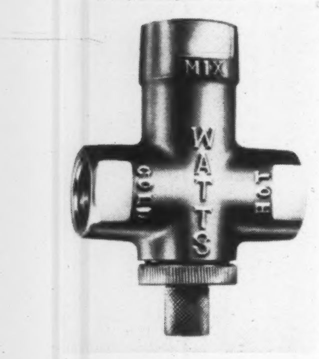
Instrument consists of stainless steel cylinder as container for sample of fuel oil to be tested, steel scale rod with piston at lower end which is precision-fitted into cylinder and timer comprised of ball sealed in fluid filled transparent tube. Operation of instrument is mechanical. Scale measures are for mechanical pressure atomizing burners and fuel oil from 70 to 215 SSF viscosity at 122 F. Other scales used for other types of industrial burners.



Vertical Steam Boiler . . .

. . . designed to provide steam for variety of industrial, commercial uses —*Sellers Engineering Co., Dept. HPAC,* 4874-76 *N. Clark St., Chicago* 40.

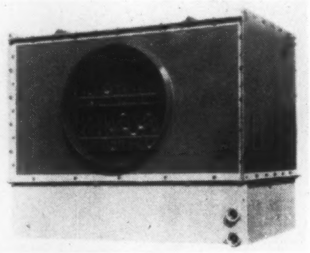
"Type H" vertical steam boiler operates with no low fire throttling; burners are full "on" or "off." Electric mercury tube type pressure switch automatically holds operating pressure. Seven models range in height from 62 to 84 in., and from $1\frac{1}{2}$ to 7 hp.



Tempering Valves . . .

. . . in three new types—*Watts Regulator Co., Dept. HPAC,* 10 *Embankment Rd., Lawrence, Mass.*

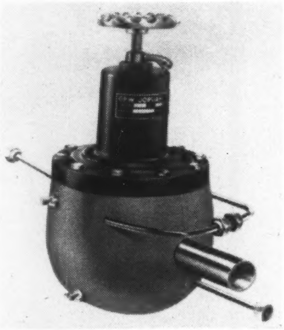
New adjustable tempering valves include: "70T" with threaded connections available in $\frac{1}{2}$, $\frac{3}{4}$ in. sizes; "No. 70" in $\frac{3}{4}$ in. size with sweat connections; $\frac{1}{2}$ in. sweat connection model. Valves have all bronze body, leakproof O-rings.



Plastic Air Washers . . .

. . . entirely fabricated of rigid PVC —*Industrial Plastic Fabricators, Inc., Dept. HPAC, Endicott St., Norwood, Mass.*

New line of air washers available in range of capacities from 1000 to 54,000 cfm designed to handle acids, alkalies, corrosive fumes. Units said to clean 96 to 99 percent of contaminants instantaneously soluble in water, such as chromic acid, sulphuric acid, caustics.

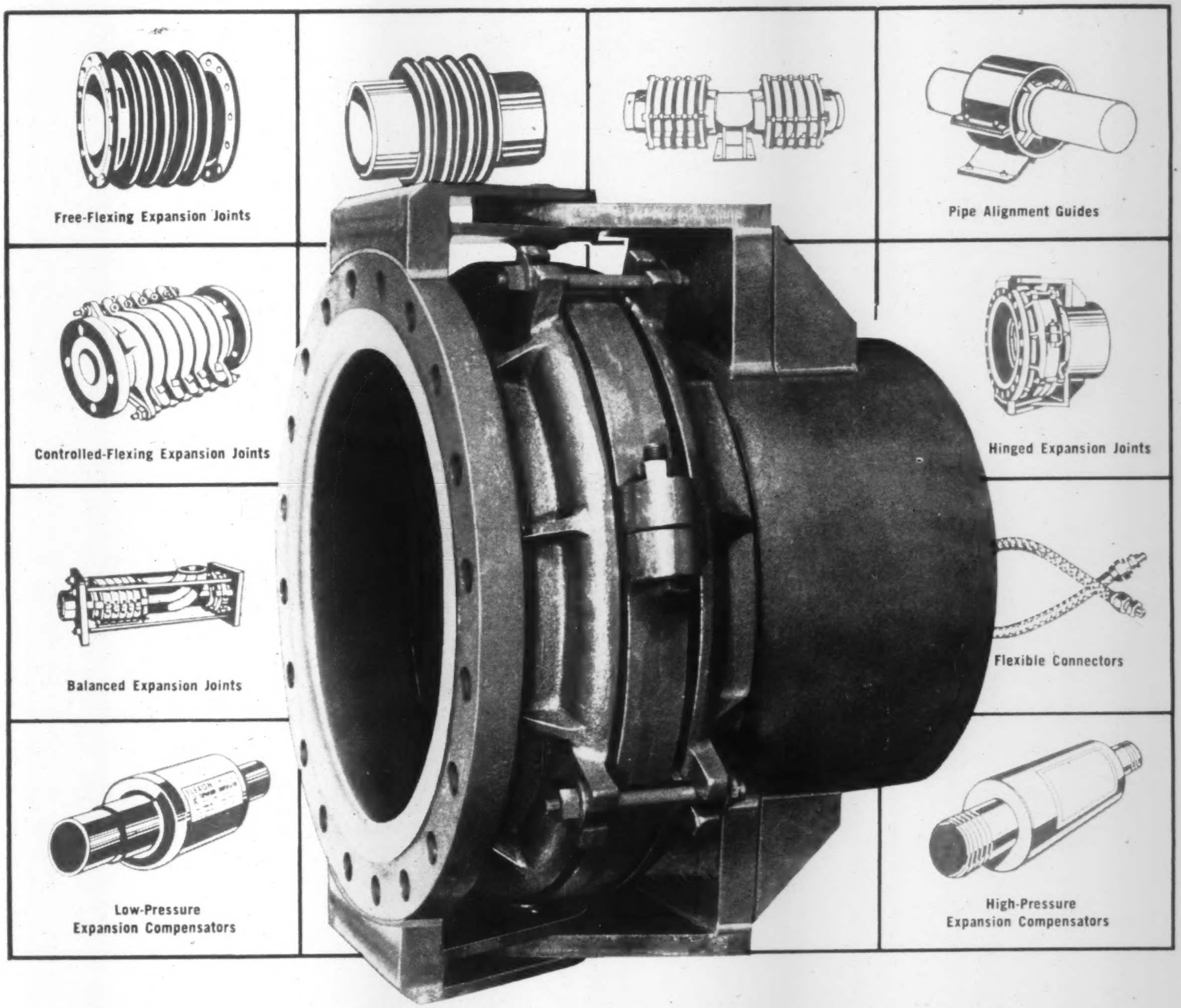


Jacketed Regulators . . .

. . . developed to surround steam tracing lines, keeping fluids from hardening or solidifying—*Jordan Corp., Div. of OPW Corp., Dept. HPAC,* 6013 *Wiehe Rd., Cincinnati* 13.

"Thermon" jacketed regulators said to work equally well for heating or cooling applications. Suitable for pressures to 250 psi and temperatures to 406 F. Sliding gate regulators available from $\frac{1}{4}$ through 6 in. size. Product described in bulletins "SRB 4-59" and "J-160."

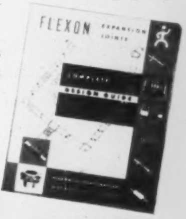
(*Continued on page* 190)


Free-Flexing Expansion Joints
Pipe Alignment Guides
Controlled-Flexing Expansion Joints
Hinged Expansion Joints
Balanced Expansion Joints
Flexible Connectors
Low-Pressure Expansion Compensators
High-Pressure Expansion Compensators

THE COMPLETE LINE TO TAKE CARE OF ANY KIND OF PIPE MOTION

For hinged or any other type of standard or special expansion joints – your best bet is FLEXONICS. Here's where you'll find the equipment, the experience, the skill to take care of any kind of pipe motion problem. Here's where you benefit from more research . . . more metallurgical care . . . more service . . . and now standard stock sizes for quick delivery from five FLEXONICS warehouses. They all add up to expansion joints that you can *install and forget* – plus expansion compensators, flexible connectors, the all-new FLEXONICS pipe alignment guides and other piping accessories.

Today—write for your copy of the Flexonics Expansion Joint Design Guide . . . 28 pages of valuable information.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DESIGN GUIDE

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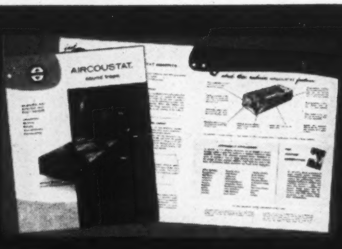
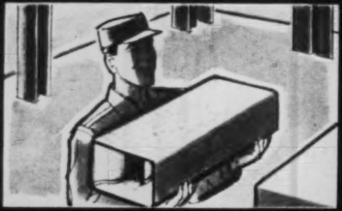
7 ways AIRCOUSTAT® can save you time and money

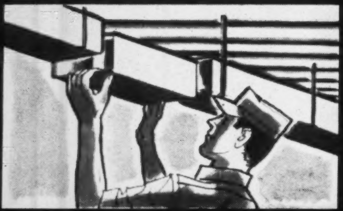
Sound Traps . . . with Guaranteed Results



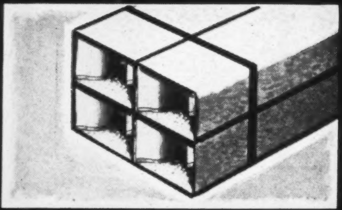
1) Easy to select—Just 3 steps to specify proper model. Save time, avoid errors.



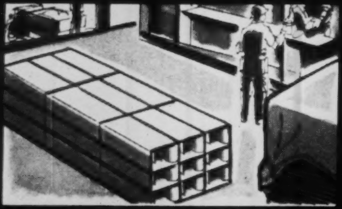
2) Easy to handle—No riggers or special equipment needed. Large units composed at job site.



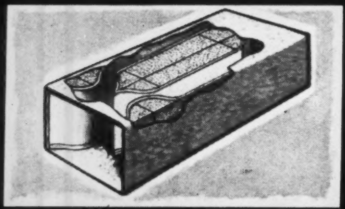
3) Easy to install—Units are installed the same as ductwork. Units have 2" extensions.



4) Fits all duct sizes—Big units are easily assembled from small Aircoustat units.



5) No storage problem—Units are delivered right to the job site, ready to install.



6) No maintenance—Units are fire-resistant, dust-proof and built to last a lifetime.

7) Guaranteed results—Solves every noise reduction problem. Units are completely reliable.

Pre-engineered by Koppers to eliminate guesswork, unnecessary calculations and difficult installations, AIRCOUSTAT Sound Traps guarantee trouble-free silencing of all duct-transmitted noise . . . at a savings in time and money to you.

AIRCOUSTAT selection is quick, simple and reliable. A choice of over 60 stock models, fabricated in 6 lengths, solves every noise reduction problem. AIRCOUSTAT is built to give a lifetime of maintenance-free service.

Write today for your copy of the AIRCOUSTAT Selection Manual, a quick guide to the right unit or combination of AIRCOUSTAT units to eliminate duct-transmitted noise in all air handling systems. Write KOPPERS COMPANY, INC., Sound Control Department, 3405 Scott Street, Baltimore 3, Maryland.

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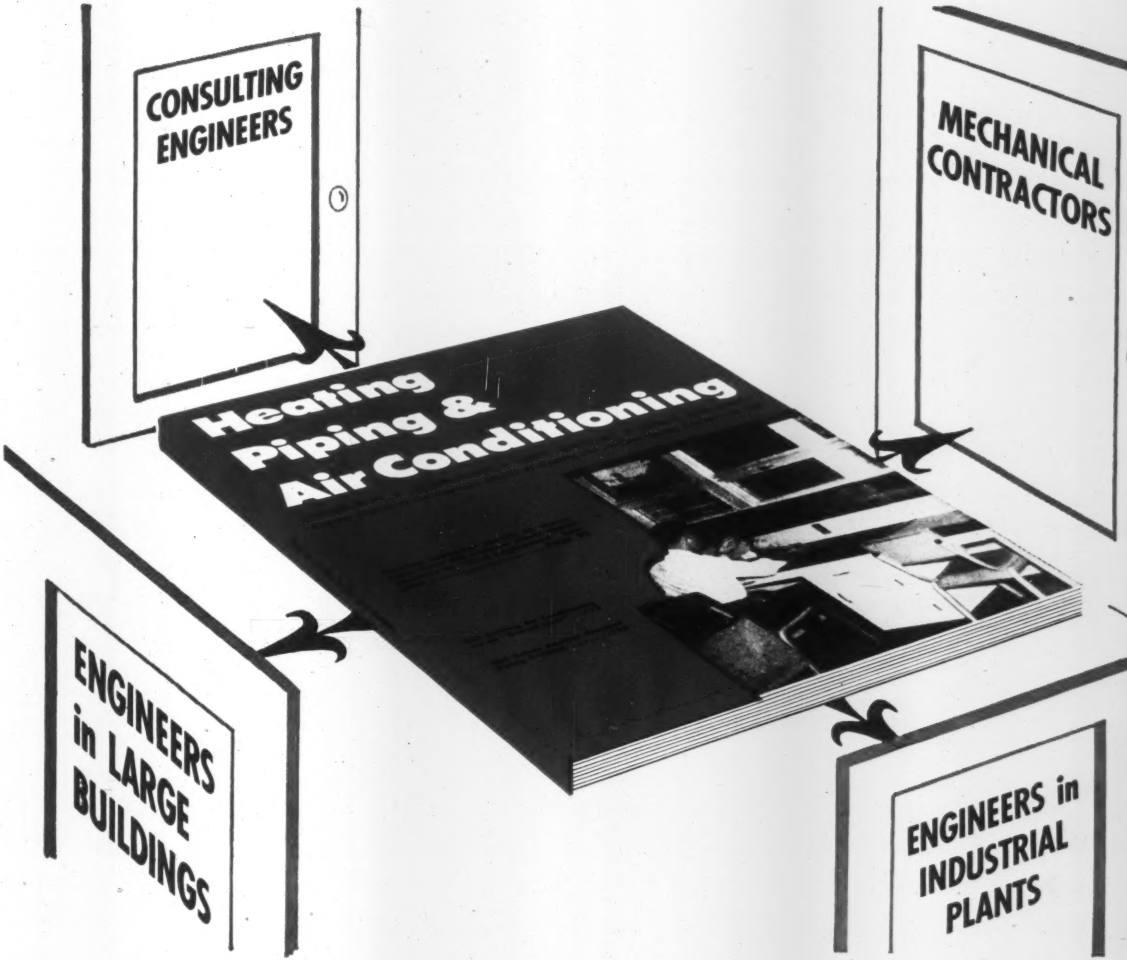
CONSULTING ENGINEERS
MECHANICAL CONTRACTORS
Heating Piping & Air Conditioning
ENGINEERS in LARGE BUILDINGS
ENGINEERS in INDUSTRIAL PLANTS

Point your selling in all 4 directions at 1 time

You must sell THE BIG FOUR to sell your heating, piping, and air conditioning products

Are you getting through to them? Impressively? Often enough? Your most economical way is to advertise in Heating, Piping & Air Conditioning.

Here's the publication that has as *paid* readers the factors who collectively purchase-control every job in the industrial-large building field.

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Complete information by return mail!

SYMBOLS OF WANTEDNESS

Heating, Piping & Air Conditioning ◆ **6 N. Michigan, Chicago**

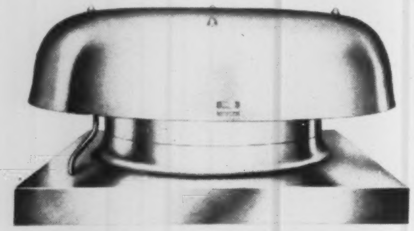
KEENEY PUBLISHING CO. AIR CONDITIONING HEADQUARTERS

Continued from page 186

High Temperature Water Boiler . . .

. . .designed for high temperature hot water heating and process work—*Boiler Engineering & Supply Co., Inc., Dept. HPAC, Manavon St., Phoenixville, Pa.*

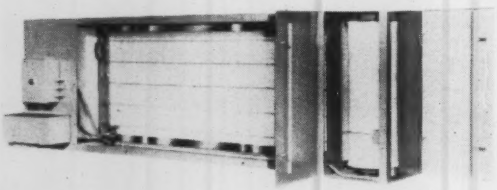
Water is circulated in "Flo-Kontrold" boiler at temperatures between 250 and 450 F with system loads from 4 to 100 million Btu per hr, but design of system is standard, says manufacturer. Circuits arranged to eliminate vapor locking; all circuits drainable at one point through bottom header, vented at one point through top header. Boiler supported on structural steel frame with enclosed welded steel casing. Designed for firing with oil, gas, combination oil-gas, or stoker for coal.



Roof Ventilator . . .

. . .in design 30 in. high from curb to top in largest size—*Loren Cook Co., Dept. HPAC, 227 Depot St., Berea, Ohio.*

"Model QD" roof ventilator is direct-drive propeller ventilator, built in 16 to 48 in. diameters, with capacities from 1200 to 38,350 cfm. Propeller consists of cast aluminum hub and individually cast aluminum blades. Largest size weighs 485 lb.



Horizontal Air Filter . . .

. . .with automatic action—*American Air Filter Co., Inc., Dept. HPAC, 215 Central Ave., Louisville 8.*

"Type H Roll-O-Matic" automatic renewable-media air filter said to require minimum of maintenance, have constant filter resistance. Renewable media consists of specially woven curtain of glass fibers which traverses face of filter, rolls up collected air contaminants, with used media, into disposable roll at side. Horizontal design developed for application on new or existing multi-zone air conditioning units, heating and ventilating units. Available in 10 sizes, ranging from 4070 to 39,000 cfm.

(Continued on page 194)

YOUR
IDEAS
WORK
BETTER
WHEN
YOU
WORK
WITH
HONEYWELL

THE FOLLOWING pages bring you some of the latest developments in automatic controls from Honeywell. They widen your choice of products, give you more to work with.

For complete information on these new control products and systems, call your nearest Honeywell sales office. Honeywell provides 112 sales offices throughout the country. Each is staffed with control specialists to assist you in writing specifications and preparing control layouts.

Now! Quality Honeywell Electronic

For multi-zone air conditioning—

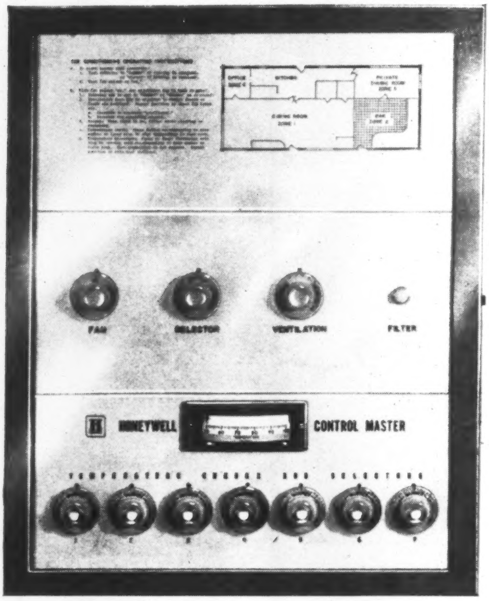
THE HONEYWELL CONTROL MASTER*

The Honeywell Control Master brings the advantages of central air conditioning control to small, multi-zone buildings. Three-module construction makes it easy to custom design units to fit the specific requirements of your clients.

Lower module contains combination temperature check button and adjustment knob for each zone. When check button for any zone is pushed, its temperature is indicated on the big, easy-to-read dial. Temperature is corrected by turning the adjustment knob.

Center module is selector switch module, custom built according to the needs of the system. May contain a main power switch, heating-cooling switch, day-night switch, pilot light for filter replacement indication, fan switch, pressure gauge . . . whatever is needed or wanted for your application.

*Trademark

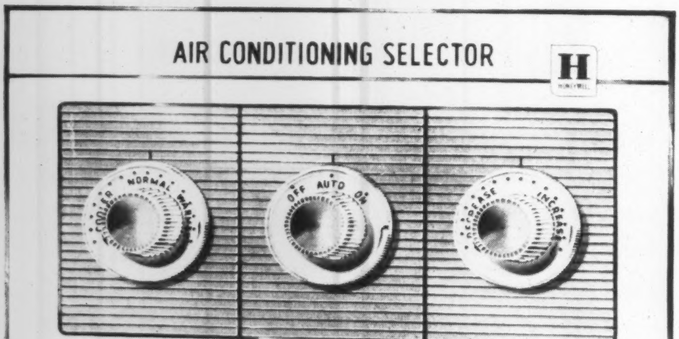


Top module gives system plan and step-by-step instructions, so that whoever is put in charge can quickly learn the operation.

Honeywell Control Masters are available for any multiple-zone application up to seven.

For single-zone air conditioning—

THE HONEYWELL AIR CONDITIONING SELECTOR



Designed expressly for single-zone air conditioning systems, the Honeywell Air Conditioning Selector provides temperature, ventilation and fan control in one convenient location. Operating in conjunction with a standard Honeywell electronic control system, it maintains the precise conditions selected.

The attractive selector plate is made of anodized aluminum. It's easy to keep clean, never corrodes. Fits four standard electrical switch boxes, easy to install and maintain.

Controls for Smaller Buildings

For the thermostat on the wall—a complete line of Honeywell Electronic Rounds

50
60
70
80
90
H
Honeywell

Honeywell now offers a complete line of electronic thermostats with world famous *round styling*. Each of the following is available with a new rugged, stainless steel cover:

- With a thermometer and with temperature setting adjustment at the thermostat.
- With thermometer and with remote temperature setting.
- With thermometer, remote temperature setting, plus element for remote temperature reading.

Every model is fast, accurate, dependable, and is available with a tamper-proof guard.

Electronic motors for any heating-cooling need

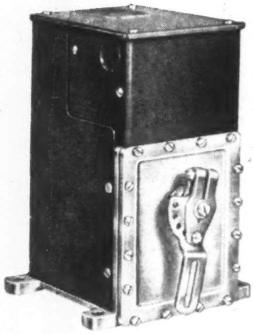
All motors in this new Honeywell line have built-in electronic relays and are designed for operation of valves, dampers, unit-ventilators and step controllers. They feature summer-winter compensation, with spring closing available as protection against current interruption.

COMPACT. These motors provide in one small package, a powerful capacitator type motor with oil-immersed gear train, integral sensitive relay amplifier and principal bridge components.

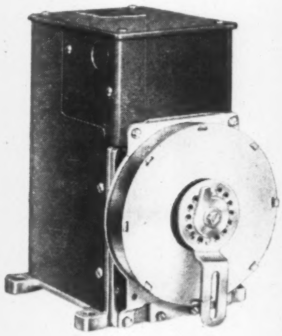
FLEXIBLE. For use with any combination of space thermostat, discharge thermostat or return-air thermostat.

RAPID RESPONSE. Changes at any thermostat are sensed immediately, interpreted by amplifier for fast, corrective action.

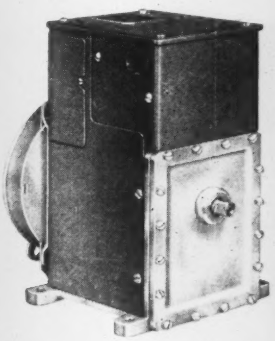
SIMPLE ADJUSTMENT. Authority, capacity balance, throttling range and calibration adjustments are made simply and accurately at the motor.



Electronic Motor for Damper, Unit Ventilator, Step Controller.



Electronic Motor for Damper application, spring return.



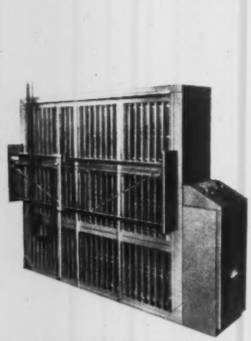
Electronic Motor for Valve applications, spring return.

NOW! FLUTTER-JET WASHING
Another first for Honeywell's
ELECTRONIC AIR CLEANER

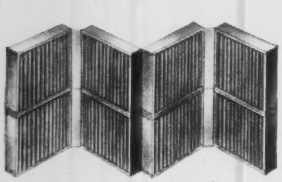
Actual unretouched strobelight photograph taken at 1/2,000 second.

Never before such a quick, efficient way to wash electronic air cleaners! Honeywell's new flutter jet washer literally *blasts* water throughout the air cleaner, with a fluttering, sweeping action that flushes away accumulated dirt quickly—cleans every part thoroughly. The new flutter jet nozzle never clogs.

Honeywell's Electronic Air cleaner
Removes 95% of all airborne dirt



Honeywell's Electronic Air Cleaner



Honeywell's Activated Charcoal Filter

You can now select from three types of cells: (1) *Hi Velocity*—for 99-100% dirt removal or where space is limited. (2) *Standard*—for normal conditions, provides high efficiency dirt removal and high dirt capacity. (3) *Hi Load* for handling high dirt concentration.

With these 3 different cell capacities, you can have complete freedom in designing your plenums. Just select the cell type and number of cells that will give you the air cleaning capacity you need in the plenum space available. No longer is it necessary to design your plenum to fit the air cleaner.

Remove Odors, Too

For the ultimate in air cleaning, team up Honeywell's Electronic Air Cleaner with the Activated Charcoal Filter—for removal of *all odors and gases*, too. Only Honeywell offers this *exclusive* combination.

For more information about Honeywell air cleaning, call your nearest Honeywell office. Or write: Minneapolis-Honeywell, Department AC-5-68, Minneapolis 8, Minn.

Honeywell

H HONEYWELL First in Control

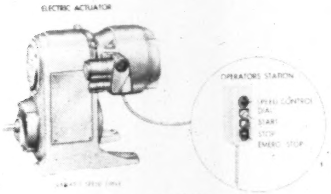
EQUIPMENT DEVELOPMENTS

Continued from page 190

Plastic Valves . . .

. . .in range of sizes from 1/4 to 2 in.—*Walworth Co., Dept. HPAC, 750 Third Ave., New York 17.*

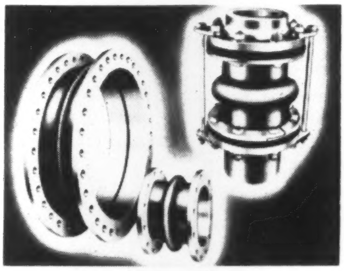
Three new sizes — 1/4, 3/8, 1 1/4 in. — in rigid PVC "Y" globe valves, check valves, strainers said to offer exceptional resistance to inorganic salts, alkalis, acids, other corrosive fluids. Units operate at pressures to 150 psi at 75 F.



Variable Speed Control . . .

. . .designed to provide remote dial control of variable speed motors—*U. S. Electric Motors, Inc., Dept. HPAC, Box 2058 Terminal Annex, Los Angeles 54.*

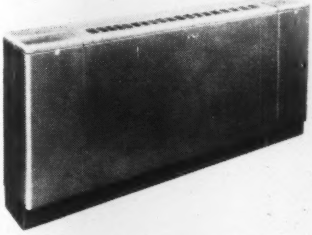
Under normal stop conditions, electric "Varitrol" automatically returns drive to low speed, protecting driven equipment from high speed starts. Emergency stop button provided to eliminate return to slow speed. Unit also gives rapid speed change of approximately 10 sec for full range. Available for motors from 1 to 60 hp.



Expansion Joints . . .

. . .designed for use with chemical, oil, water or exhaust steam lines operating at temperature of 180 to 200 F—*Raybestos-Manhattan, Inc., Manhattan Rubber Div., Dept. HPAC, 61 Willett St., Passaic, N. J.*

Expansion joints intended for either pressure or vacuum operation said to give necessary protection from internal expansion and contraction, vibration, corrosion, and erosion; also compensate for misalignment. Available in spool type, straight sleeve, and other approved types.



Air Conditioning Units . . .

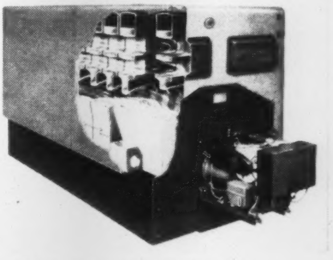
. . .in new design 8 1/2 in. thick × 25 in. high or deep—*McQuay, Inc., Dept. HPAC, 1600 Broadway, N. E., Minneapolis 13.*

"Seasonmaker" air conditioning units available in four models — for ceiling, hideaway, floor, and basic installation — each in five sizes. Units utilize central station heating and cooling with capacities of 220, 330, 440, 520 and 640 cfm. Features cited by manufacturer: reversible coils; galvanized steel cabinet construction.

Refrigerant Cylinders . . .

. . .designed to ease cylinder handling, simplify servicing operations—*Union Carbide Chemicals Co., Div. of Union Carbide Corp., Dept. HPAC, 30 E. 42nd St., New York 17.*

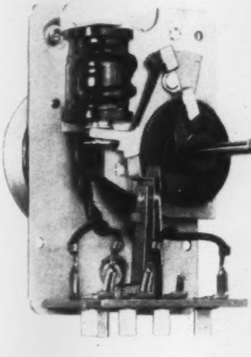
Ring-top refrigerant cylinders made for packaging company's "Ucon" refrigerants in 10 and 25 lb cylinders. Cylindrical ring-top steel shield used for valve protection. Company's refrigerants 12, 22 and 114 are packaged in these cylinders.



Boiler-Burner Units . . .

. . .developed for No. 5 oil and combination gas-light oil—*Weil-McLain Co., Dept. HPAC, Michigan City 22, Ind.*

Cast iron boiler-burner units available in capacity range of 3395 to 12,260 sq ft of steam. Furnished with atomizing pressure type burners, integrated with electronic controls, special combustion chamber design. Designed for No. 5 oil, but will handle all grades of lighter oils. Combination gas-light oil units can burn either gas or No. 2 fuel oil.



Coil Defrost Control . . .

. . .for applications with outside heat pump coils—*Paragon Electric Co., Dept. HPAC, Two Rivers, Wis.*

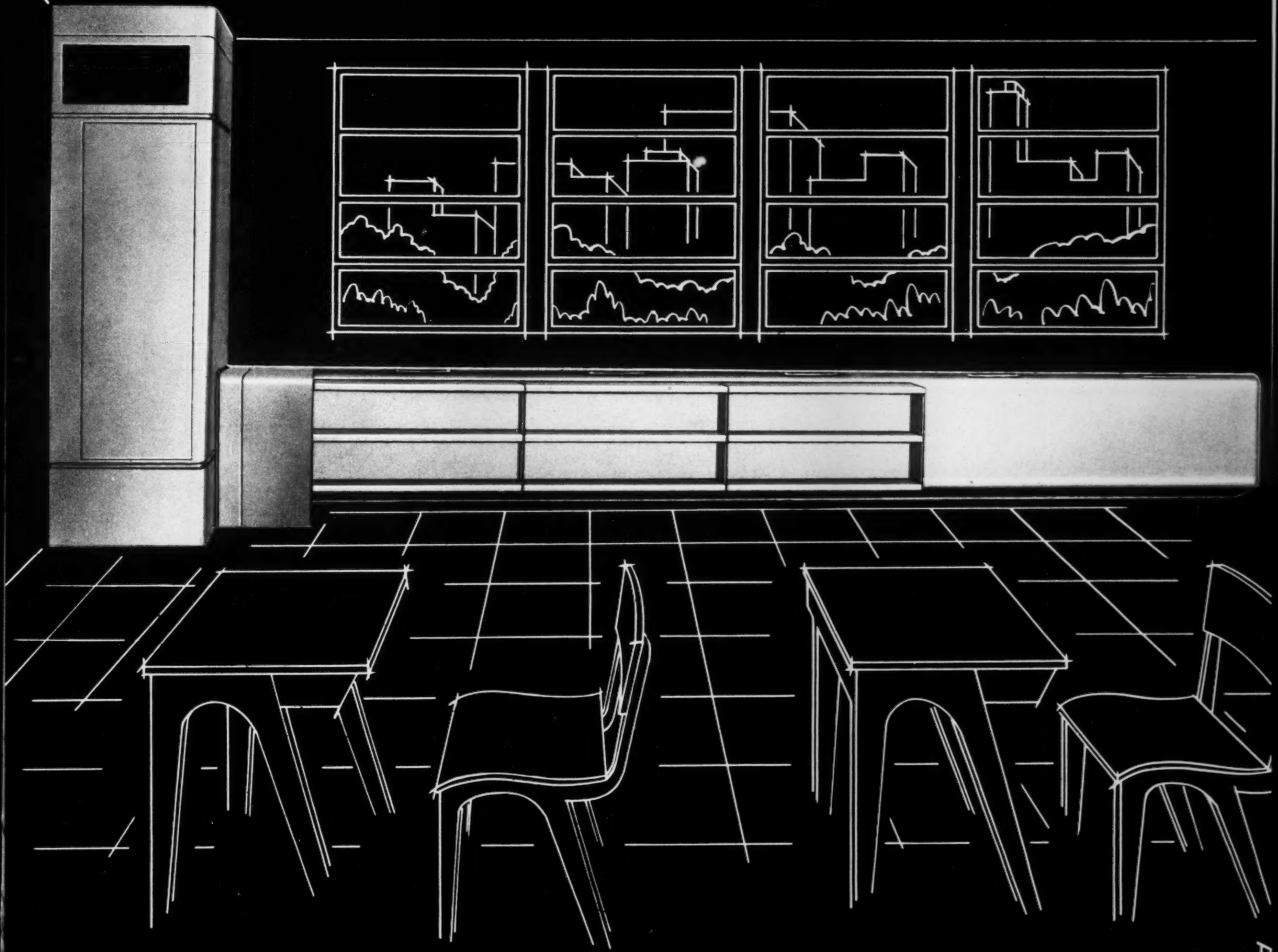
"230 Series" defrost control enclosed in molded, plastic housing for weather protection. Remote control termination can be added; defrost cycle can be initiated by time, terminated by actuation of remote thermostat or pressure bellows; timed fail-safe can be provided to terminate on time.

(Continued on page 198)

A.I.A. FILE NO. 30-A

new JANITROL

school heating – ventilating – cooling system with draft-free perimeter distribution



for
- new schools
- add-on school rooms
- modernization

JANITROL HEATING AND AIR CONDITIONING DIVISION
SURFACE COMBUSTION CORP., COLUMBUS 16, OHIO

A.I.A. FILE NO. 30-A

NOW . . . any schoolroom can have modern comfort at modest cost!

The new Janitrol school comfort system is a self-contained, individual-room heating and ventilating system (with optional summer cooling) that features perimeter-type, draft-free air distribution, recognized as the best way to comfort condition a schoolroom. The system may be installed very economically (saving as much as 60% over large central systems), and extra savings will continue, due to the low operating and maintenance costs.

The standard system consists of (1) a floor-to-ceiling metal cabinet which encloses the gas-fired heating and ventilating unit and (2) wall duct sections that occupy unused space and provide efficient, perimeter distribution of the conditioned air. If extra space-saving storage is desired, matching shelves may be included with the wall ducts initially, or added at any future time.

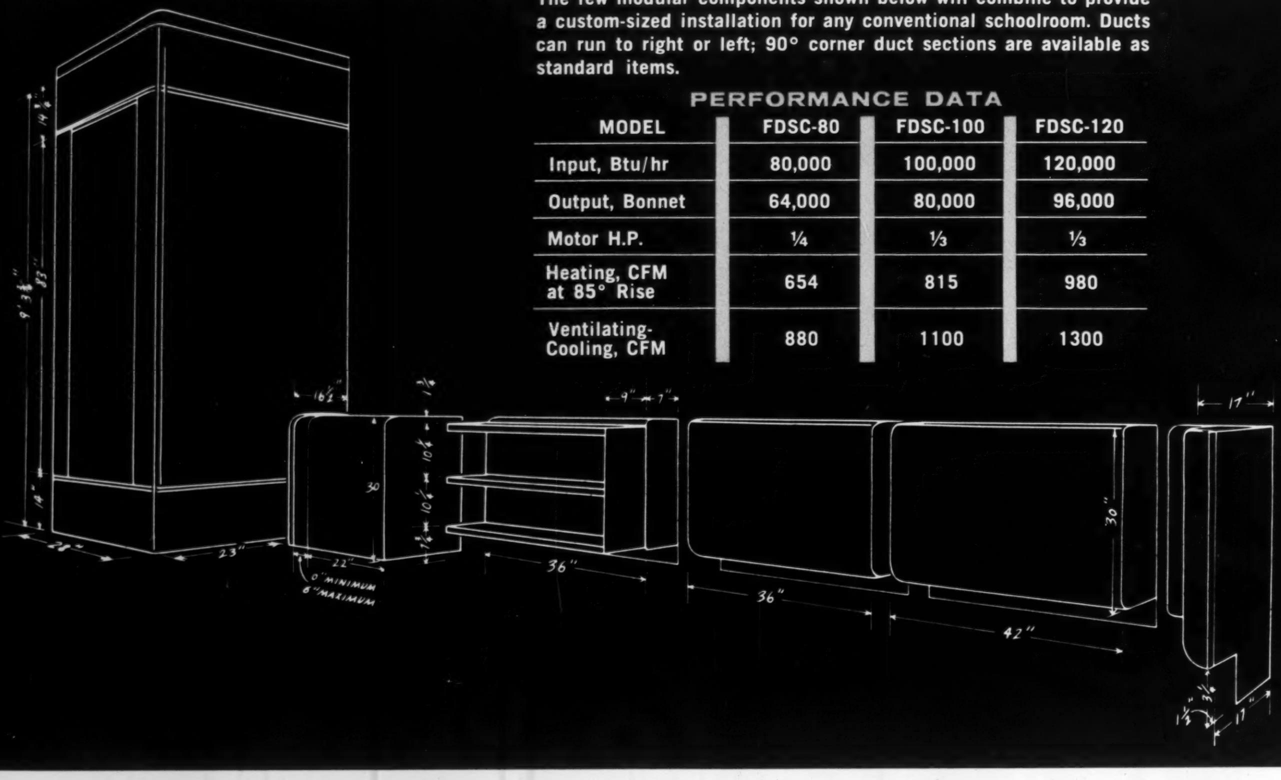
The modular sections of the system permit unusual flexibility in installation for new schools, additions to existing structures or for modernization of older schoolrooms. Installation may be made after all construction work is completed, if necessary.

dimensions – capacities

The few modular components shown below will combine to provide a custom-sized installation for any conventional schoolroom. Ducts can run to right or left; 90° corner duct sections are available as standard items.

PERFORMANCE DATA

MODEL	FDSC-80	FDSC-100	FDSC-120
Input, Btu/hr	80,000	100,000	120,000
Output, Bonnet	64,000	80,000	96,000
Motor H.P.	¼	⅓	⅓
Heating, CFM at 85° Rise	654	815	980
Ventilating-Cooling, CFM	880	1100	1300



OPERATING FEATURES

The gas-fired heating unit is A.G.A. approved as a forced-air furnace for closet installation and as a unit heater for all types of gasses, including LP, so even schools off the gas lines can use this system. For maximum fuel economy during non-school hours, heating may be automatically, or manually cut back, and outside ventilating air intake closed. **All combustion air is supplied from a separate outside air inlet — no combustion air is drawn from the classroom.**

In the perimeter-type air distribution system, the wall ducts are placed along the walls below the windows, and distribute the conditioned air upward across the exposed wall, and window surfaces and throughout the room. Each wall section has adjustable diffusing outlet with locking damper control to accurately balance the air flow. To avoid floor drafts, all circulated air is returned to the unit at ceiling level.

• • • • • • • • • • • • • • • • • • • •

An unusually quiet-operating centrifugal blower, rubber cushioned in an acoustically-insulated compartment, circulates the conditioned and filtered air. **There is no mixing of air between rooms.** Outside fresh air, in quantities adjustable to meet local codes, is automatically brought into the classroom during school hours and blended to insure draft-free comfort. The system is thermostatically controlled to provide uniform room temperature at all times. Many classrooms need cooling, even in winter, due to unusual heat gain from the sun, lights and students. On these occasions, the system will automatically bring in 100% unheated out-door air, in increased volume, until room temperature moderates.

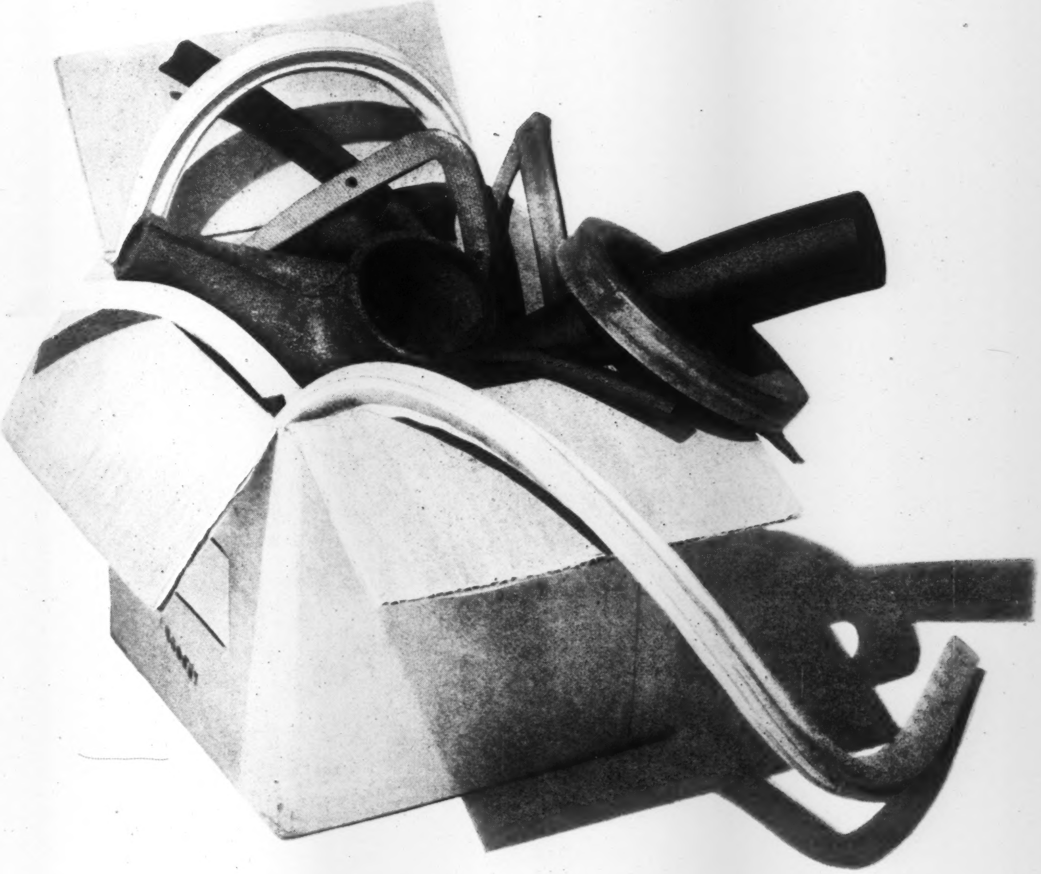
An inherent feature of the Janitrol system is the economical method of providing summer air conditioning for individual rooms that are used frequently during the warm season. The insulated unit base compartment is designed to receive the summer air conditioning coil without major system alterations. Standard Janitrol summer air conditioning equipment may be included as a part of the original installation, or may be added later at reasonable cost by a competent air conditioning contractor.

FREE-NEW DESIGN FILE

Write for your file of complete technical and specification data on school heating and air conditioning.

JANITROL HEATING AND AIR CONDITIONING DIVISION
SURFACE COMBUSTION CORPORATION
DEPT. S-95 COLUMBUS 16, OHIO

B.F.Goodrich



If it sweats, rattles, shakes or leaks . . .

. . . it shouldn't! And if you ask B.F.Goodrich, it won't! B.F.Goodrich, as the largest producer of sponge rubber and cellular plastic, makes special or standard parts for the refrigeration and air conditioning industry. Typical functions of these parts are sealing, gasketing, insulating and vibration damping — under the most trying conditions.

So get the advantage of the experience that has put B.F.Goodrich cellular materials into The Sheraton Hotel, Philadelphia; The Conrad Hilton, Chicago; The Corning Glass Building, New York and many other New York office buildings. Write The B.F.Goodrich Company, 581 Derby Place, Shelton, Connecticut.

B.F.Goodrich ***industrial cellular materials***

Sylphon® Compensated Regulator Cuts Heating-Ventilating Control Costs

Self-adjustment prevents DROOP

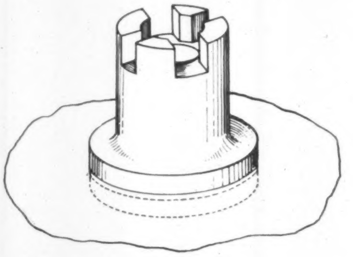
These self-powered, single-seated steam regulators provide modulating temperature control of heating and ventilating systems at dramatic savings in cost and maintenance. Self-adjusting bulb prevents "droop" . . . delivers uniform discharge temperature regardless of weather or load changes. Packless valve construction with monel Sylphon bellows. Covers any 60° range from 0°F. to 170°F. Sizes ½" to 2". For complete details on this No. 928 Series Temperature Regulators, write for Catalog JH.

Mr. Controls

Robertshaw-Fulton

CONTROLS COMPANY

FULTON SYLPHON DIVISION • Knoxville 1, Tenn.



Integral Fan Hubs . . .

. . . integrally formed with fan spiders and blower backplates and having special external shapes—*Air Impeller Div., Torrington Mfg. Co., Dept. HPAC, Torrington, Conn.*

Integral casting of hub with spider or backplate said to provide more rigid, torque resistant construction. Special external hub shapes such as spline may be die-cast as couplings. Irregular bore shapes, such as D-bore, also available.

Multi-Fuel Furnace . . .

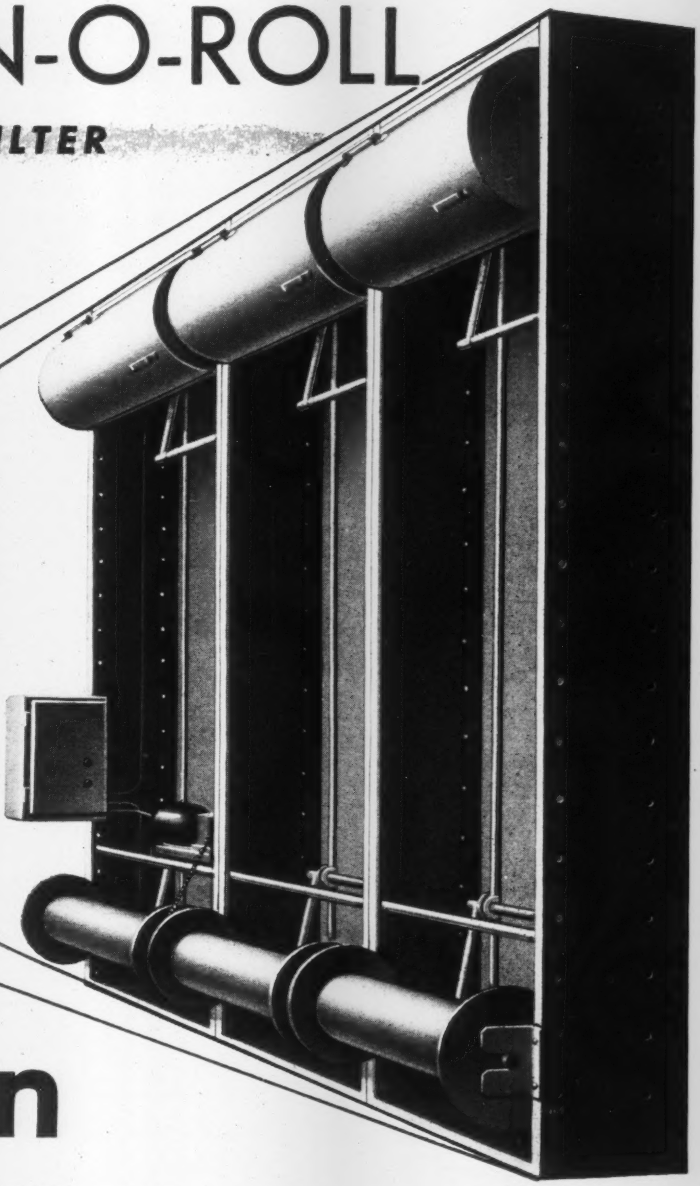
. . . with stack and firebox principles to allow burning of conventional fuels, as well as all kinds of rubbish—*Mastro-Hoskinson Mfg. Corp., Inc., Dept. HPAC, 640 Hempstead Turnpike, Franklin Square, Long Island, New York.*

Furnace delivers up to 400,000 Btu per hr when fired with gas or oil, and up to 500,000 Btu per hr when burning rubbish. Heater's feed door is 30 in. wide and 14½ in. high; unit weighs 1000 lb. Removable heat exchanger can be slipped out of furnace for cleaning. An 1800 to 3600 cfm fan permits ducts to be connected. Because burner is

EASY to install – completely prewired – takes a minimum of working space

Green ECON-O-ROLL

AUTOMATIC AIR FILTER



Green's ECON-O-ROLL Automatic Air Filter can be installed by ordinary labor since no special skills are required.

The electrical control panel is completely prewired, eliminating the need for costly on-the-job wiring. Since ECON-O-ROLL filter sections are shipped completely assembled, installation requires only setting the sections in place, bolting to fan station enclosure and bringing electrical power source to the control panel.

There are many types of control systems available from which to choose.

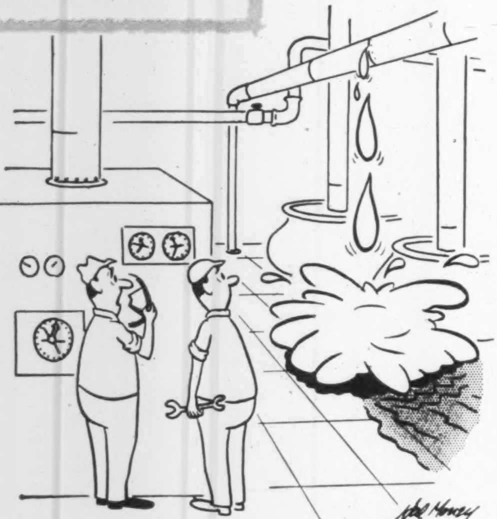
For additional information, write for our Bulletin #176.

Green

THE GREEN FUEL ECONOMIZER CO., INC.

BEACON 3, NEW YORK

Life in these excited states...



"I can't stand that constant drip-drip-drip!"

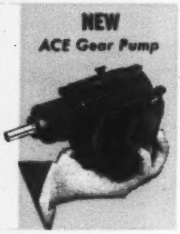
Corrosion got the drop on you?

Little drips can mean big losses... repairs, downtime, ruined equipment. You can put an end to 85 to 100% of these problems with Ace chemical-resistant rubber and plastic piping, valves, pumps, tanks and other equipment. American Hard Rubber Company's 108 years of experience is at your service.

All-purpose rigid PVC. Sched. 40, 80 & 120, ½ to 4". Threaded or socket-weld fittings. Valves ½ to 2". NSF-approved. *Bul. CE-56.*

RIVICLOR
for ageless strength

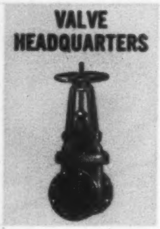
Improved design . . . now 12 gpm. All wetted parts acid-resistant, wear-resistant Ace hard rubber. Finest available. *Bul. CE-55.*



Flexible poly pipe, ideal for water lines, drains, underground pipe or conduit. Sizes ½ to 2", long coils, NSF-approved for drinking water. *Bul. CE-57.*

SUPPLEX
tops in economy

World's best chemical valves . . . at moderate prices. All-plastic, rubber-lined, or all-hard-rubber. ⅛" pet cocks to 24" gate valves.



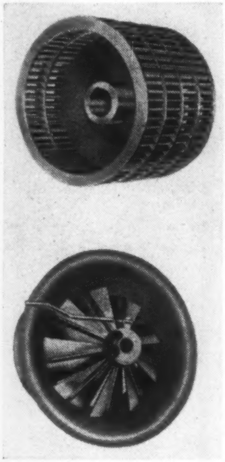
ACE processing equipment of rubber and plastics

See our pages in cec Catalog!

AMERICAN HARD RUBBER COMPANY
DIVISION OF AMERACE CORPORATION
Ace Road • Butler, New Jersey

EQUIPMENT DEVELOPMENTS
Continued

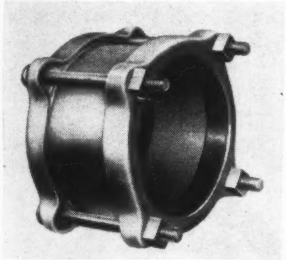
mounted on track, heater can be converted from oil or gas burner to rubbish disposal unit by sliding barrel out of trap door in rear of furnace.



Fans and Inlet Vanes . . .

. . . designed to provide high air movement to size ratio—*Chicago Blower Corp., Dept. HPAC, 9867 Pacific Ave., Franklin Park, Ill.*

Designed for heavy duty draft operation, fans have number of forward curved blades of mild or alloy steel, with housings of continuous-weld, heavy steel plate, rigidly braced. Wheel diameters in 16 sizes offered. Outlet duct sizes vary from 18 to 77 in. Two speed ranges available.



Aluminum Pipe Coupling

. . . in design combining compression sealing with lightness, strength of aluminum—*Dresser Mfg. Div., Dresser Industries, Inc., Dept. HPAC, 49 Fisher Ave., Bradford, Pa.*

"Style 38 Alumilite" aluminum couplings available in sizes 2 to 6 in. OD for irrigation, suction, food

(*Continued on page 204*)

HOFFMAN *Complete line of* STEAM SPECIALTIES

Here is another example of the complete quality line of Hoffman specialties, designed to give you better control of every requirement—one-pipe or two-pipe residential or industrial systems. The "Watchman" Centrifugal Type Condensation Pumps feature cast iron receiver, a vertical drive, and close coupled pump for perfect alignment and accessibility. Submerged parts are bronze or other non-corrosive material. Hoffman "Watchman" Pumps offer a small compact unit for low pressure heating systems.

WCD-8-20 Duplex Unit for systems up to 8,000 sq. ft. E.D.R. and 20 lbs. disc. press.

WC-8-20 Single Unit for systems up to 8,000 sq. ft. E.D.R. and 20 lbs. disc. press.

WC-12-20 Single Unit for systems up to 12,000 sq. ft. E.D.R. and 20 lbs. disc. press.

HOFFMAN SPECIALTY MFG. CORP. 1700 West 10th Street, Indianapolis 7, Indiana

VALVES, TRAPS, VACUUM AND CONDENSATION PUMPS, FORCED HOT WATER HEATING SYSTEMS
STOCKED AND SOLD BY LEADING WHOLESALERS OF HEATING AND PLUMBING EQUIPMENT

TRADE FRICK MARK®

Air Conditioning & Refrigeration

Serving the Great BARNES HOSPITAL . . . WASHINGTON UNIV. MEDICAL CENTER at St. Louis, Mo.

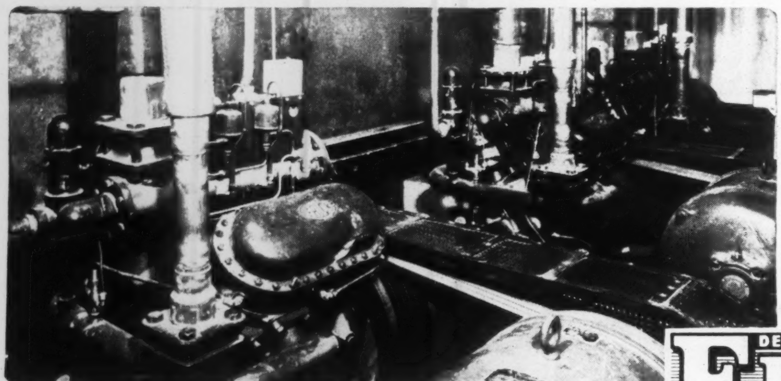
7½-Ton Frick unit air conditioner serving four research and lecture rooms.

Here 11 Frick unit air conditioners and 42 Frick compressors supply the necessary cooling services for operating rooms, private rooms, auditorium and chapel, class rooms, nurse-interns' dormitories, offices, libraries, laboratories, cafeterias, kitchens, special freezers, research departments, morgues, animal rooms, etc. Installation by L. V. Fleiter Co., Inc., Frick Distributors in St. Louis, Missouri.

Whether you need conditioned air, cold water, ice, cold rooms, or very low temperatures,—for human comfort, food service, process work, quick freezing, research, or any other commercial or industrial purpose,—there's a Frick system to meet your exact requirements.

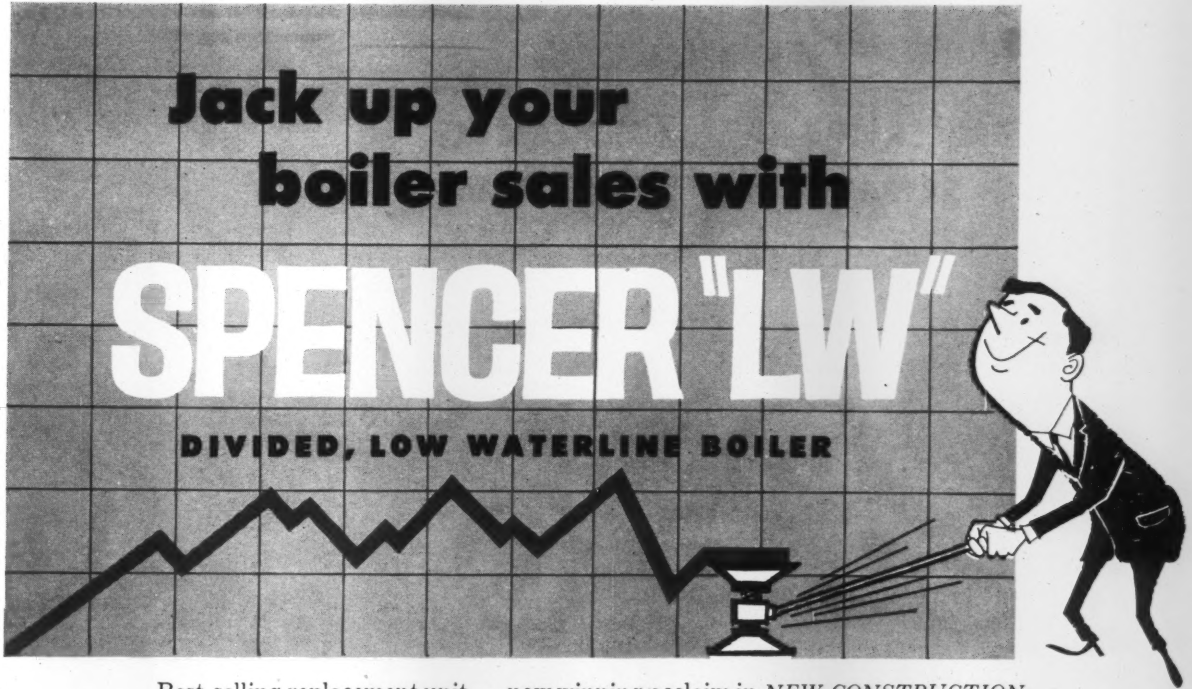
Let us quote now on the equipment you need.

Write . . .
wire . . . phone or visit.



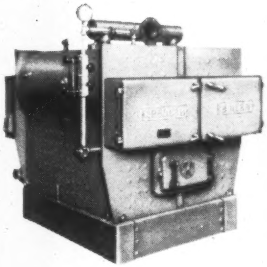
Three Frick "ECLIPSE" compressors which air condition several operating rooms at Barnes Hospital, St. Louis.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA., U. S. A.



Best-selling replacement unit . . . now winning acclaim in *NEW CONSTRUCTION MARKET* for its high efficiency, fast steaming, low installation and maintenance costs . . . *SALES RESPONSE PROVES IT!*

LOOK AT THESE UNIQUE PRODUCT ADVANTAGES!

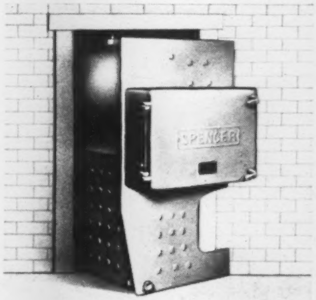


LOWER WATERLINE

Over-all height of the Spencer "LW" is 25% less than conventional firebox boilers . . . eliminates pit usually required in new buildings for conventional commercial boilers . . . eliminates high excavation costs.

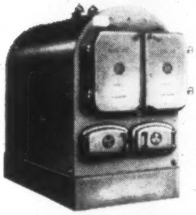
BUILT IN TWO SECTIONS

Divided design allows entry in existing buildings through narrow basement openings. Two watertight sections are moved in separately . . . no welding for installation.



Plus Spencer "LW" features a full 5″ *waterleg* for fast-steaming, heat-saving, efficient operation. The "LW" is available in a complete range of sizes: from 2,200 to 42,500 sq. ft. steam SBI ratings.

BUILD UP YOUR BOILER BUSINESS WITH SPENCER

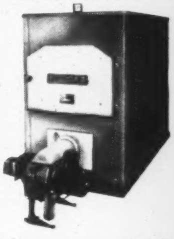


SPENCER "A"

Complete range of sizes from 3,500 to 50,000 square feet steam SBI ratings . . . ideal installation for *every* building . . . for *every* fuel.

NEW SPENCER "C"

Oil-fired package unit complete with burner, controls and refractory base. Reduces installation costs — gives outstanding performance.



SPENCER
HEATER
LYCOMING DIVISION
WILLIAMSPORT Avco PENNSYLVANIA

For complete details on the boilers shown, or on any of the residential or commercial boilers in Spencer's complete line, write to: Spencer Sales, Avco Corporation, Williamsport, Pa.

"from Chicago"

the new "IMMERSIPUMP"* SUBMERSIBLE NON-CLOG SEWAGE and SUMP PUMP

*Trademark

- Low Original Cost
- Low Maintenance Cost
- Easy To Install
- Easy To Service
- Pump And Motor Operate Completely Submerged

FOR Pumping Sewage And Other Liquids Containing Solids . . . and Sump Pump Applications

The new "Chicago" IMMERSIPUMP* is a development of 50 years of experience in the research, engineering and manufacture of sewage and sump pumps for buildings, industrial plants and municipalities.

The finest materials are used . . . to assure years of trouble-free service. No superstructures are required for outdoor installations . . . minimum head room is required for indoor installations. The Stainless Steel Bail enables easy installation and removal of the unit. The enclosed Non-Clog pump impeller passes solids up to 2½". The pump casing is made of close-grained, cast iron . . . the shaft of Stainless Steel. A separate Suction Plate, with tripod, is furnished to support the entire unit . . . enabling easy, quick access to the Impeller.

The Motor is specially designed for submersible operation . . . being totally-enclosed and oil filled to positively assure against water entering the unit.

. . . *available with the new* SEALTRODE* Sealed Electrode Floatless Pump Controller . . . the *only* Controller featuring completely sealed Electrodes . . . positively preventing insulation or coating by grease or other corrosive elements.

"Chicago" Distributors are located in most principal cities. See the one nearest you today for full details.

1909 50 YEARS 1959 CHICAGO PUMP COMPANY

Putting Ideas to Work

FOOD MACHINERY AND CHEMICAL CORPORATION

Chicago Pump Company

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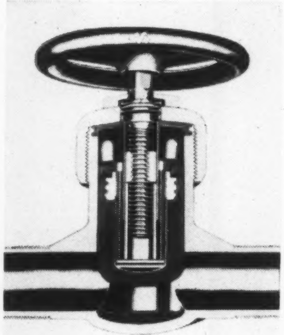
EQUIPMENT DEVELOPMENTS

Continued from page 200

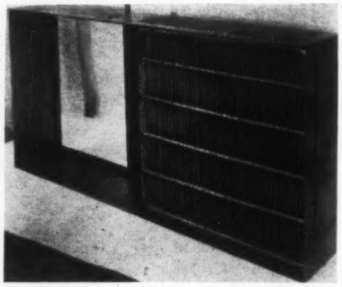
processing, pneumatic, transmission and pressure line applications in dry bulk materials handling, oil and chemical piping, other industries. Couplings permit 6 deg of pipe deflection, handle working pressures to 150 psi, absorb vibration, expansion and contraction, other stresses.



Plastic Valve . . .

. . . with telescopic method of tight sealing—*W. S. Rockwell Co., Dept. HPAC, 200 Eliot St., Fairfield, Conn.*

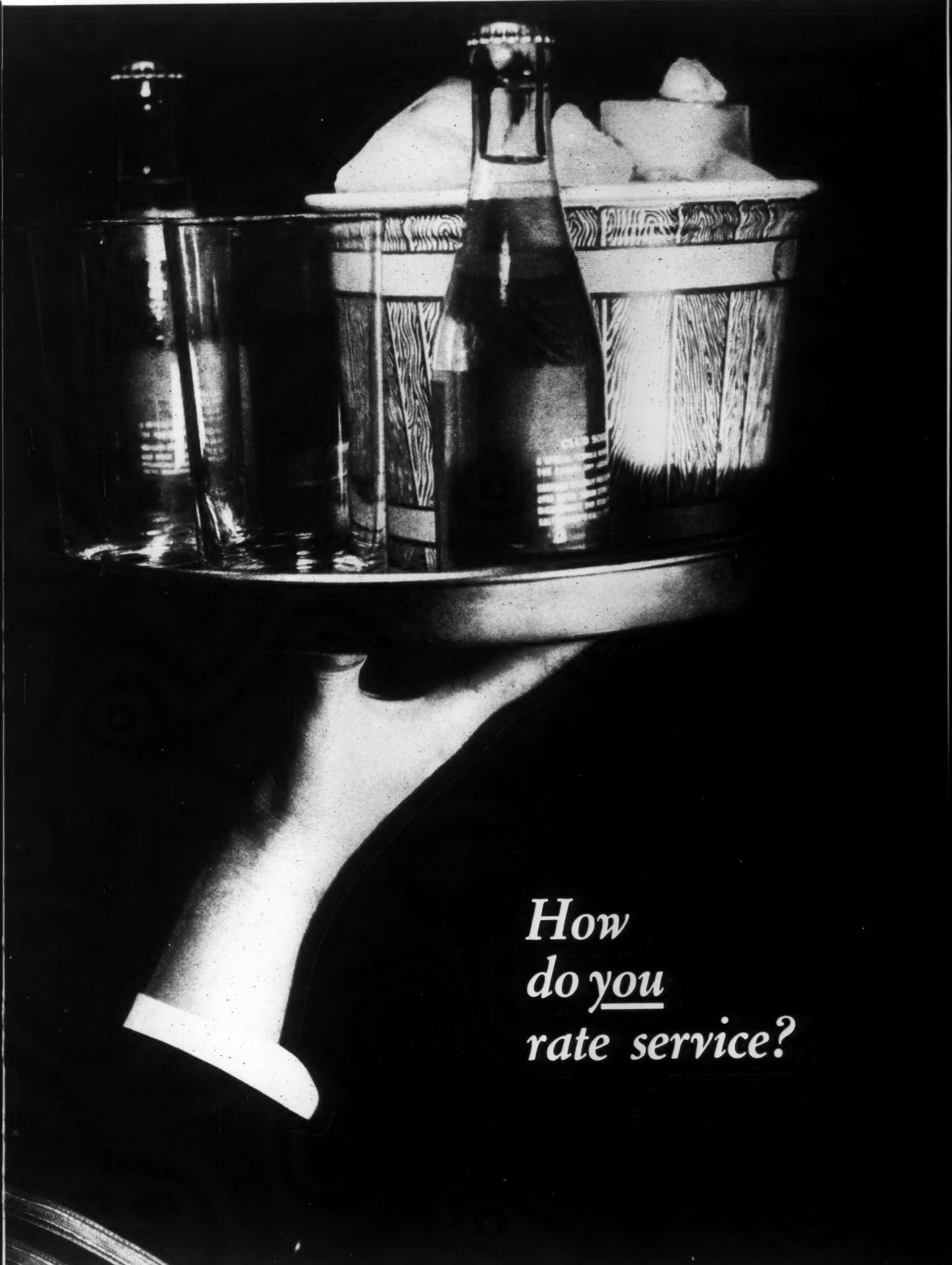
In sealing, plastic valve's soft rubber cup forced to concave bottom of passage. Cup under pressure from stem said to seal on all sides against walls of body casing, shutting off flow. Soft rubber cup accommodates particles of foreign matter without harming sealing characteristics. Valve can be installed in metal or plastic piping systems. Available with screwed or flanged ends or with socket ends. Working pressure 145 psi; all valves tested at 230 psi. Sizes from 1 to 4 in. provided.



Air Filter . . .

. . . designed to eliminate "bulk release" of dust—*Mine Safety Appli-*

(*Continued on page 208*)


How
do you
rate service?

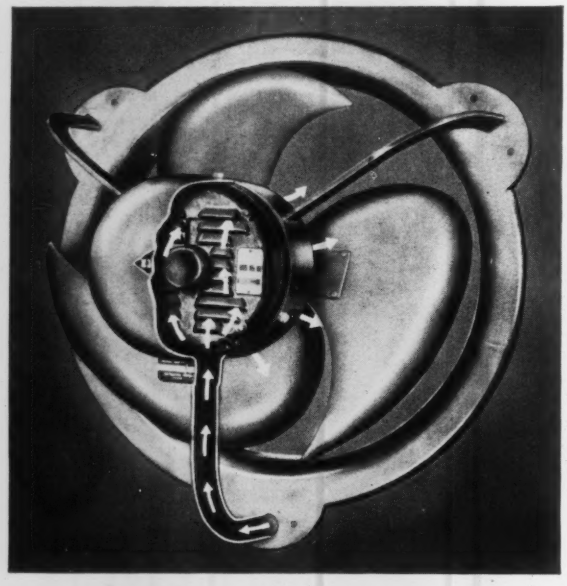
How do you rate service?

when it's length of service . . .

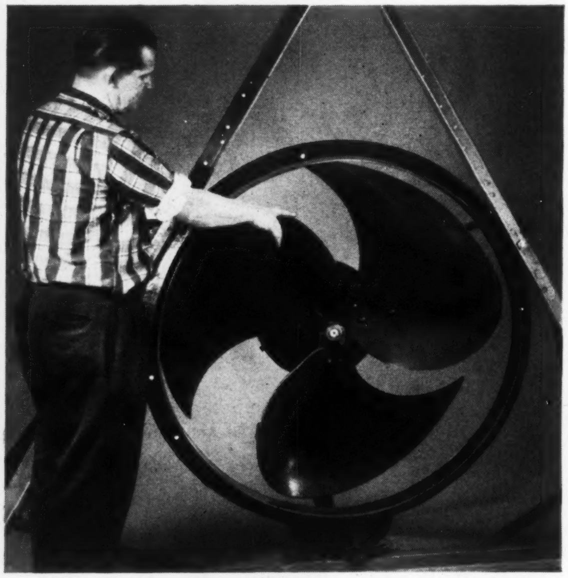
Every day you find more hotels and motels installing Ilg electric ventilating equipment. Recently 161 more of these institutions turned to Ilg.

Why this growing preference for Ilg? Some of the reasons are shown below. Ilg fans and ventilators—car-

Here's why ILG propeller fans last a lifetime



Cool, Clean, Quiet. With Ilg propeller fans you get the operating cost advantages of *open-type* motors plus the protection of *totally enclosed* motors. Vent pipe brings in outside air to *pressure-cool* single-phase permanent-split capacitor and 3-phase motors. Casing protects motor windings against deposits. "One-Name-Plate" guarantee covers *both* fan and motor.



Finger-Tip Control. Ilg Type "Q" propeller fan wheels and motors are dynamically balanced to assure vibration-free performance. Ilg-built self-cooled, direct-connected, permanently lubricated motors always run cool, clean and quiet.

For fans built to satisfy your "specs". . .

Each Ilg product shown carries the rating seal of the Air Moving and Conditioning Association Inc.

CERTIFIED RATINGS

AUTHORIZED BY
AMCA

Ilg ventilating equipment rings the bell with 161 hotels and motels

rying a "One-Name-Plate" pledge of performance on complete unit—ring the bell with consulting engineers and building owners and operators because: Ilg products guarantee proper ventilation . . . cost little to operate . . . need virtually no maintenance for years and years.

For further details on the complete line of Ilg electric ventilating equipment, send for Catalog No. 159 on propeller fans, Bulletin No. 257 on *airfoil* centrifugals, Bulletins Nos. 2302 and 2701 on power roof ventilators.

and ILG *centrifugal fans with little maintenance*

"Check-Out" Time. Every Ilg-built centrifugal fan wheel—with backward curved (BC) blades and *airfoil* design—must pass dynamic balancing "check-out" tests before being direct-connected to 3-phase motors or to permanent-split capacitor single-phase motors.

Streamlined for Smooth Flow. Large air-intake area . . . gently curved inlet contour . . . combine to assure smooth intake of air. No bearing or bearing supports in intake to hamper air flow. Discharge arrangements easy to rotate on the job. No belts or pulleys to slip, realign or replace. For operations to 9" static pressure.

specify ILG

ILG ELECTRIC VENTILATING COMPANY
2826 No. Pulaski Road, Chicago 41, Ill.
Offices in 57 Principal Cities
Member of Air Moving and Conditioning Association Inc. (AMCA)

RAWL
SABER-TOOTH
DRILL-N-ANCHOR
fastest way to fasten to concrete
RAWL SABER-TOOTH
R

It's a drill...and drills its own hole fast, even in hard concrete, with power-operated or hand hammer. Saber-Tooth's core action drills quickly. Drill and anchor are one...matching sizes is no problem. Save the cost of special drills, the time it takes to use, store and sharpen them.

It's an anchor...and holds fast: engineering tests demonstrate holding power up to 17,860 lbs. As you drive it into hole, anchor expands over plug...holding ridges around body resist pull-out. Saber-Tooth anchor withstands severe shock and vibration...double plating protects against rust, corrosion.

Anchor anything to concrete—easily, quickly, permanently—with Saber-Tooth, sure-holding heavy-duty masonry anchor that drills its own hole.

Put steel expander plug in drill end of Saber-Tooth, drive home...anchor expands over plug, at bottom of hole for greatest holding power.

See for yourself how easily you can anchor anything to concrete...send the coupon for free sample Saber-Tooth and full information.

THE RAWLPLUG COMPANY, INC.
252 Petersville Road New Rochelle, N.Y.
Please rush my Saber-Tooth sample and complete facts.

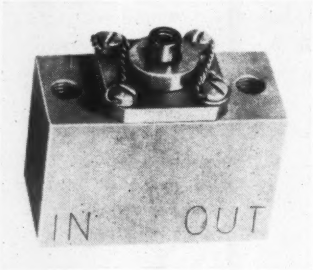
Name..
Firm..
Address..
....
R4

EQUIPMENT DEVELOPMENTS

Continued from page 204

ances Co., Dept. HPAC, 201 *N. Braddock Ave., Pittsburgh* 8.

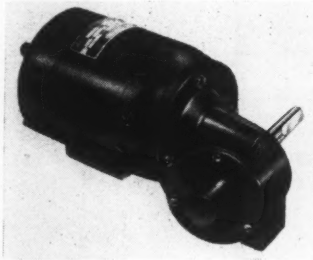
"Dustfoe" space filter has 1000 cfm capacity. Available initially in 24 × 24 × 6 in. size. No oil used to collect dust in unit. Recommended by manufacturer for filtering applications in electronics, photographic industries, other high filtration applications.



Pressure Indicator . . .

. . . designed to raise red button in view when differential pressure exceeds stated value—*Aircraft Porous Media, Inc., Dept. HPAC*, 30 *Sea Cliff Ave., Glen Cove, N. Y.*

"Deltadyne" differential pressure indicator unit activated by differential pressures as small as 5 psi in systems with internal pressures as high as 5000 psi. Unit intended for use in −65 to 275 F systems and can be used to detect clogging of filters, spray nozzles, injection nozzles, report excessive pressure drop in fluid system. Can be used with orifice or other flow restrictor to detect insufficient or excessive flow.



Gear Motor . . .

. . . designed for both universal and induction applications—*Howard Industries, Inc., Dept. HPAC*, 1700

FIRST in Airfoil Bladed Fans

50% more used than any other make

"Chicago" Airfoil Fans solve 3 tough problems in Koppers Building

Consulting engineers, Peter F. Loftus Corporation, were faced with three limitations in planning the year 'round air conditioning system for this 28-year-old building:

1. Fans had to run extremely quietly because of adjacent offices.
2. Fan equipment rooms had to be small to conserve rental space.
3. No alterations on the exterior of the building were permitted.

"Chicago" Airfoil Centrifugal Fans met these specifications perfectly. Their efficiency (92%) enabled the consulting engineer to move the required volume of air with much smaller fans and motors. This not only saved valuable floor space, but also saved horsepower. Their quiet operation (65% less noise) prevented tenant complaints.

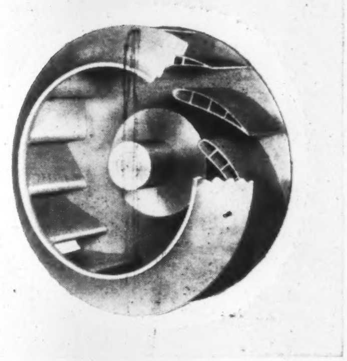
Engineers have recognized the superiority of "Chicago" Airfoil Bladed Fans since they were first introduced in 1951 and have specified them for . . .

General and heavy duty applications in . . .

- Air supply and exhaust
- Mechanical draft
- Industrial processing
- Building and tunnel ventilation
- High pressure and conventional ventilation

28-Year-Old Koppers Building Pittsburgh, Pa.

Air conditioning this 33-story building was the largest installation ever attempted in the Pittsburgh area.



65% less noise, 35% less horsepower, 92% efficiency with "Chicago" Airfoil aerodynamic wheel design

First major advancement in 40 years obsoletes conventional flat bladed designs.

Air passes over the all-welded airfoil shaped blades with less turbulence, greatly reducing air "roar" and current consumption.

Fans available in all capacities, classes and pressures.

Clip coupon and mail for catalog and data on Koppers Building!

Find Your Nearest Agent in the YELLOW PAGES

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CHICAGO BLOWER CORPORATION
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☐ Send free 64-page Airfoil Centrifugal Catalog A-103
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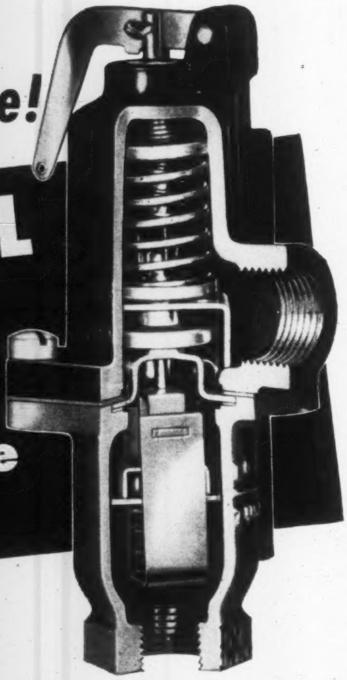


McDONNELL
202 Series
PRESSURE-TEMPERATURE
Relief Valve
V NB A.S.M.E.

—but this P-T Valve is for the TOUGH JOBS that Call for something BETTER!

Yes, it's the old story of not sending a boy to do a man's job. The McDonnell 202 Series Combined Pressure-Temperature Relief Valve costs more because it is built to breeze right through normal jobs . . . with reserve stamina that really shows up on the *tough* ones—such as those high temperature hot water installations supplying dish washers and similar units where the temperature is really up there.

Its extra cost is small compared to the satisfaction of knowing that these close-limit jobs are being provided with the absolute maximum of accuracy and safety they require.

Pressure relief capacity of the 202 Series is rated on steam discharge by the National Board, an official testing organization for the ASME. Temperature relief capacity is rated on hot water discharge by the A.G.A. Opening temperature, 188° F.; full open at 208° F.

Try the 202 Series on those critical jobs where the best is needed. It will give you the powerful, positive performance that is so sadly lacking in the ordinary P-T Valve. And when you see how well it works on the tough ones, you will put it on every hot water tank and heater on your list.

Write for complete engineering and price data.

No. 202NF —
Without fixture connection (For high temperature jobs)

No. 202 —
With fixture connection (For average temperature jobs)

Protection by rating—not guessing

Valve illustrated is available for opening pressures of 75, 100, 125 and 150 psi., rated:—

Opening Pressure	Pressure Relief A.S.M.E.
75 psi.	415,000 Btu./hr.
100 psi	532,000 Btu./hr.
125 psi.	650,000 Btu./hr.
150 psi.	765,000 Btu./hr.

Doing One M&M SAFETY CONTROLS REG. U. S. PAT. OFF. *Thing Well*

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

EQUIPMENT DEVELOPMENTS

Continued

State St., Racine, Wis.

Gear motor available in ratios from 10:1 to 60:1. Unit consists of "Model A-26" gear reduction unit in combination with either "Model 29-00" induction motor or "Model 29-500" universal motor. As universal a-c/d-c shunt motor, new unit has ratings of from 1/70 to ¼ hp and torque output of up to 60 in. lb. As induction unit, it is available in 2 pole and 4 pole models from 1/70 to 1/15 hp with same range of torque ratings.

Pressure Probe . . .

. . . which may be provided with any number of measuring points—*United Sensor & Control Corp., Dept. HPAC, Box* 127, *Glastonbury, Conn.*

Water cooled total pressure probe has all-welded stainless steel construction. Individual pressure measurements can be made at each point. Cooling water circulated through tubes and either sprayed out into air stream or returned to water pump. Can be used to take high velocity measeurements and thrust measurements in high velocity flames.

Compressor Noise Control

. . . based on principle that transmission and reflection of sound waves is related to density—*Westinghouse Electric Corp., Dept. HPAC, Box* 2278, *Pittsburgh* 30.

Instead of returning refrigerant gas directly to chamber adjacent to compressor, some of it is passed through oil surrounding compressor to create sound-deadening foam. Compressor piston also has agitator attached to drive shaft. In operation, agitator flails oil, creates additional bubbles.

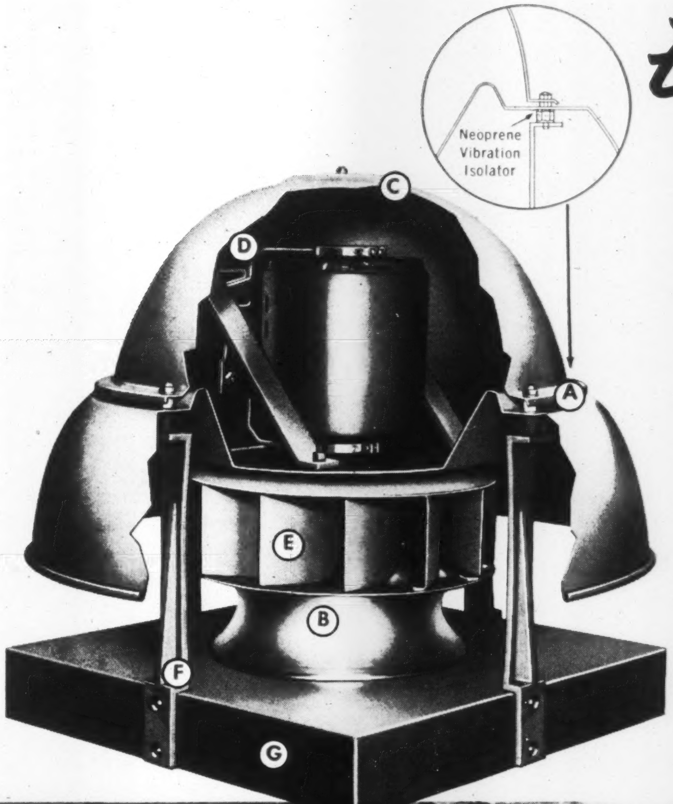
Pump Motor . . .

. . . developed specifically for industrial short-coupled turbine pumps—*U. S. Electrical Motors Inc., Dept. HPAC, Box* 2058 *Terminal Annex, Los Angeles* 54.

"Unibase" motor has one-piece

Feature by Feature...
COMPARE
Exit-Aire

the complete line of power roof ventilators



ExitAire exhausters are designed and built to provide the finest ventilation available at modest cost. Compare the unprecedented performance features of the ExitAire with those of other ventilators!

A. NEOPRENE VIBRATION ISOLATORS for silent operation (see illustration at left). Motor compartment is supported by 4 rugged cast aluminum brackets, insulated from vibration to curb by individual Neoprene "sandwich" dampeners. Motor is resiliently mounted. No need for rubber curb mountings.

B. NEW "AIRE-FLOW" INLET CONE similar to centrifugal blower-type for maximum efficiency with air turbulence reduced to a minimum. Allows use of smaller wheel which is quieter in operation and easier to keep in balance.

C. LOW SILHOUETTE conforms with modern architecture!

D. DISCONNECT SWITCH provided for mounting in motor compartment. Standard on single speed unit 10" and larger.

E. NEW WHEEL DESIGN delivers more capacity, horsepower for horsepower, than conventional wheels! Small size enhances balance.

F. CURB-MOUNTED BRACKETS! For extra rigidity, unit is suspended by 4 cast-aluminum brackets attached directly to the curb.

G. COMPLETE CURB MOUNTING! An integral part of unit, no extra cost!

ExitAire Specified for Engineering Building, Cal-Poly College, Pomona, California.

This installation of 15", 18" and 24" ExitAire Power Roof Ventilators is typical of many jobs all over the country where ExitAires have been chosen because of their higher efficiency per ventilating dollar.

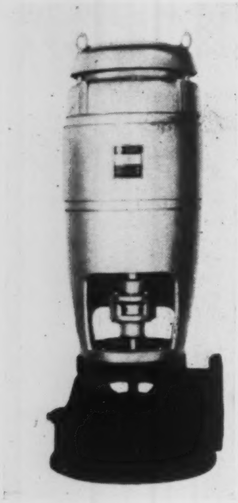
EXITAIRE GIVES YOU CERTIFIED PERFORMANCE RATINGS, TOO!

ExitAire Power Exhausters carry the Certified Rating Seal of the Air Moving and Conditioning Association ... Underwriters' Laboratories, Inc. listing on most power units. You can be *sure* when you specify ExitAire!

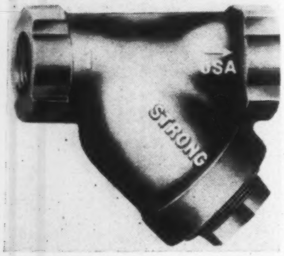
Compare—you'll buy *ExitAire!*

Write for Bulletin 458, A.I.A. File No. 12K2 with complete specifications and engineering data.

Exit-Aire COMPANY
P. O. Box 276, Pacoima, California



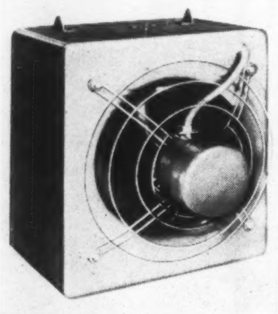
cast base as integral part of motor, assuring alignment, concentricity of motor shaft to coupling, eliminating vibration, according to manufacturer. Available in range of sizes from 7½ to 125 hp on frames sizes from 254 to 445.



Stainless Steel Strainers

...designed to provide reliable service under severe conditions of high temperature, high pressure, and corrosion—*Strong, Carlisle & Hammond, Dept. HPAC,* 508 *Sandusky St., Conneaut, Ohio.*

Stainless steel strainers for applications as in-line fittings in steam, liquid, gas, and chemical lines. Type 316 stainless steel used for body, cap, gasket, and screen. Replaceable screens available with 0.045, 0.062, and 0.125 in. perforations. Strainers produced in screwed or socket weld connections for standard pipe sizes from ½ to 2 in. Maximum non-shock working pressures vary from 650 to 3000 psi over temperature range from −50 to 1200 F. Bulletin "SS-143" describes product.



Electric Unit Heaters . . .

...with increased capacity—*Ilg Electric Ventilating Co., Dept. HPAC,* 2850 *N. Pulaski Rd., Chicago* 41.

Capacity of company's electric heater line has been increased from 7½ to 36 kw with the addition of seven newly designed units. Units have replaceable black-heat type elements; safety design eliminating bare wires, terminals in air steam; totally enclosed motor with "Q" type fan wheel. New units cover heating range up to 122,832 Btu per hr.

Another
CAINS
COIL OF PROFIT
PRE-FAB-RIC

A PREFABRICATED FLEXIBLE DUCT CONNECTION

Simply pull out desired length from dispenser-type carton. (It pulls out ready to use.) Roll into round duct or form into square duct and join. Saves 70% time over old methods. DOUBLE-SAFE-LOCKED

A TYPE, SIZE, AND PRICE FOR ALL JOBS

THREE GRADES
Commercial - Economy
Residential

THREE FABRICS
Canvas - Asbestos
Neoprene

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SOLD ONLY THROUGH JOBBERS AND DISTRIBUTORS
Some Territories Open for Manufacturers Agents Calling on Jobbers and Distributors
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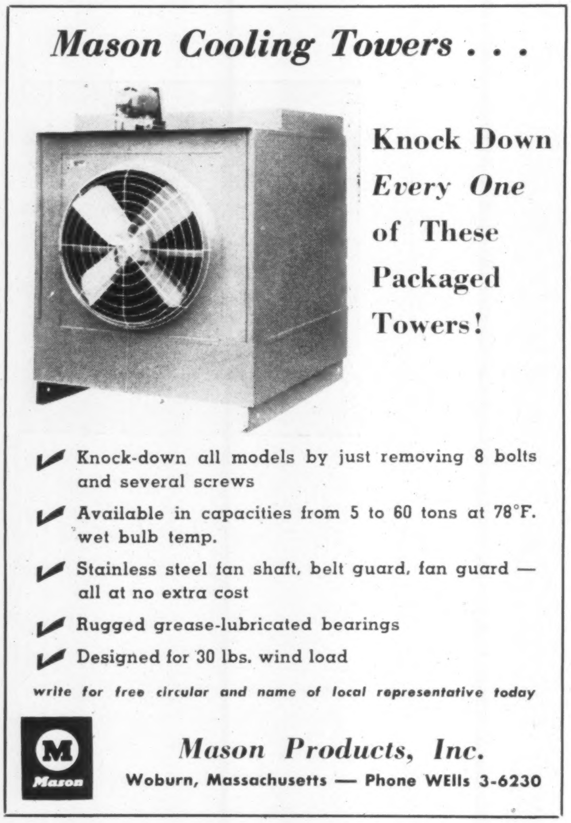


Mason Cooling Towers . . .

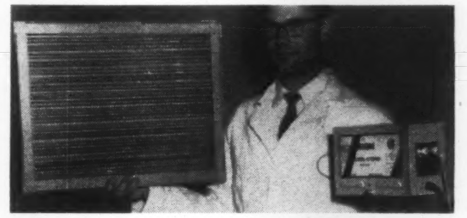
Knock Down *Every One* of These Packaged Towers!

- Knock-down all models by just removing 8 bolts and several screws
- Available in capacities from 5 to 60 tons at 78°F. wet bulb temp.
- Stainless steel fan shaft, belt guard, fan guard — all at no extra cost
- Rugged grease-lubricated bearings
- Designed for 30 lbs. wind load

write for free circular and name of local representative today

M Mason

Mason Products, Inc.
Woburn, Massachusetts — Phone WElls 3-6230



Electronic Air Cleaner . . .

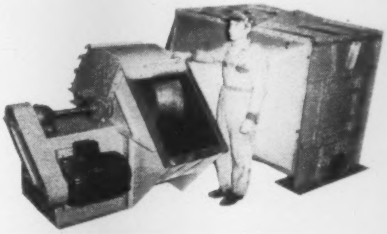
. . . for small commercial installations—*Trion, Inc., Dept. HPAC, 1000 Island Ave., McKees Rocks, Pa.*

"DFL" electronic air cleaner is 2 in. deep in direction of air flow, in most cases, can be installed in same area occupied by standard disposable filter, according to manufacturer. Air cleaner removes particles from air as small as 1/2,500,000 in. Unit equipped with 6 ft power cable to permit remote control. Available in capacities from 640 to 1000 cfm.

Packaged Air Conditioning Units . . .

. . . rated at 40 and 50 tons cooling capacity—*Westinghouse Air Conditioning Div., Dept. HPAC, Box 510, Staunton, Va.*

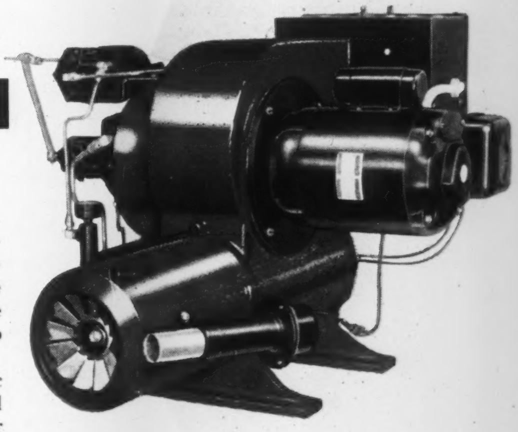
Single compressor units are 36 in. wide; cooling sections are 110 in. long. Units available with three sizes of water-cooled condensers; or without water cooled condenser for air cooled or evaporative condenser applications. Each unit has six-row evaporator coils.



Fan and Scrubber . . .

. . . in new package unit design—*Robinson Ventilating Co., Dept. HPAC, 155 Henderson St., Zelienople, Pa.*

Unit consists of scrubber, transition and fan, is designed to handle sulphuric, hydrochloric, and low concentrate nitric acid fumes, or batch pickling systems. All parts exposed to air stream lined with 1/8 in. neoprene. Scrubber composed of extruded PVC impingement baffles. Piping, spray nozzles also of PVC. "Type J" fan, of heavy duty steel construction, is of non-overloading backward curve design. Available in volumes from 5000 to 40,000 cfm with fan blade sizes from 27 to 49 in.



Keep heating costs low with HEV-E-OIL commercial-industrial burners

Hev-E-Oil burners furnish all the air necessary for combustion, assuring perfect fire control under all weather conditions. Low fire start that builds up gradually to the flame size required means smooth, safe operation. And once the burner is set for greatest efficiency, it *stays* that way no matter what the weather.

A complete package! Fire tested! Automatic, electronic controls. Meets all codes. Easy to install . . . Hev-E-Oil models from 5 to 150 gph. Also available, Hev-E-Duty power gas burners and combination gas/oil burners from 720,000 to 21,000,000 B.T.U.

For more information write Industrial Combustion, Inc., 4507 N. Oakland Ave., Milwaukee 11, Wis., Dept. HPA-559.

INDUSTRIAL COMBUSTION INC.

EXECUTIVE OFFICE: 4507 N. OAKLAND AVE., MILWAUKEE 11, WISCONSIN

Advantages of Constant Volume Regulators in High Velocity Air Transmission

. . . greater design flexibility, stable air delivery, self-balancing operation of branch ducts are typical benefits

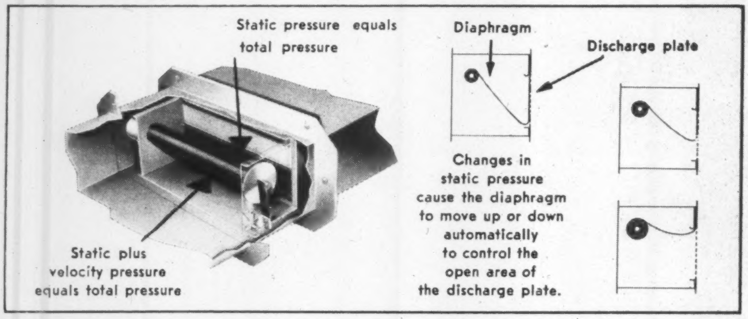

Static pressure equals total pressure
Diaphragm
Discharge plate
Changes in static pressure cause the diaphragm to move up or down automatically to control the open area of the discharge plate.
Static plus velocity pressure equals total pressure

Fig. 1 — Model SCR constant volume regulator can be installed anywhere in a duct system where there are changes in static pressure. It maintains cfm delivery within ±5% for inlet air pressure differences as high as 6 to 1.

The function of a constant volume regulator is twofold:

1. To reduce high velocity air to conventional velocities;
2. To deliver a constant cfm flow as supply duct pressures change.

Constant volume regulators provide automatic compensation for static pressure variation, and assure balanced system performance under a wide range of operating conditions.

Barber-Colman now makes available a line of standard constant volume regulators and control units to meet nearly every application.

Model SCR Regulator

The completely self-contained, self-operated Barber-Colman constant volume regulator, illustrated in Fig. 1, has proved to be a highly accurate and reliable device. It can be installed anywhere in a single- or double-duct system to maintain constant cfm delivery, regardless of pressure changes upstream or downstream, including those caused by operation of mixing valves or face and bypass dampers.

As illustrated, a flexible diaphragm is actuated by changes in static pressure to control the area of the discharge opening. No separate power source is required. The regulator will operate on as little as 0.5 inches of static pressure in the duct.

Both static and velocity pressure exist under the flexible diaphragm where the air can pass through the discharge plate. Static pressure exists only above the diaphragm where the air is trapped. A static pressure increase above the diaphragm forces it downward against spring pressure, limiting the open area. Conversely, when static pressure decreases, the diaphragm raises, exposing a larger opening area.

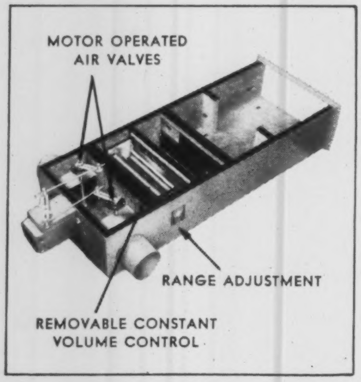

MOTOR OPERATED AIR VALVES
RANGE ADJUSTMENT
REMOVABLE CONSTANT VOLUME CONTROL

Fig. 2 — Model CV double-duct control unit combines mixing valves with a constant volume regulator.

The spring tension of the diaphragm roller is set at the factory to meet job requirements, but it can be easily adjusted in the field should requirements change.

Double-Duct Control Units

Three basic types of Barber-Colman double-duct control units combine the basic constant volume regulator with hot and cold air mixing valves. The two valves are controlled by a single motor operator as illustrated in Fig. 2. The housing is acoustically lined to assure very low noise levels.

Standard units meet above-the-ceiling, under-window, or sidewall installation requirements in the vast majority of cases. Modified units are available for unusual situations.

Figs. 3 through 7 illustrate typical applications and the design flexibility of these regulators and control units.

New High Velocity Manual

A new 52-page manual has been developed by Barber-Colman to provide engineers a handy reference source to high velocity design considerations. In addition to a general discussion, it includes data on duct design, air requirements, return air systems, fan selections, temperature control, balancing procedures, and Barber-Colman control units.

Ask for Catalog No. F-6598-1. Call your local Barber-Colman air distribution field office or write.

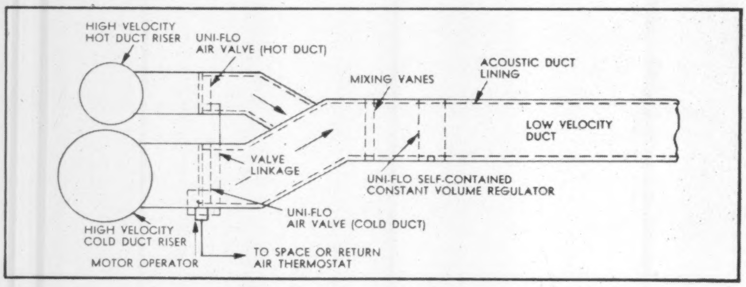

HIGH VELOCITY HOT DUCT RISER
UNI-FLO AIR VALVE (HOT DUCT)
MIXING VANES
ACOUSTIC DUCT LINING
LOW VELOCITY DUCT
VALVE LINKAGE
UNI-FLO SELF-CONTAINED CONSTANT VOLUME REGULATOR
UNI-FLO AIR VALVE (COLD DUCT)
HIGH VELOCITY COLD DUCT RISER
MOTOR OPERATOR
TO SPACE OR RETURN AIR THERMOSTAT

Fig. 3 — Double-duct system with motor-operated air valves for hot and cold air mixing and a model SCR regulator to provide constant cfm delivery to the low velocity duct. A Model CV unit (Fig. 2) could be used instead of the two valves and the single SCR regulator.

Instead of a single SCR regulator, individual ones can be installed in branch ducts. In this case, the low velocity duct system would be self-balancing.

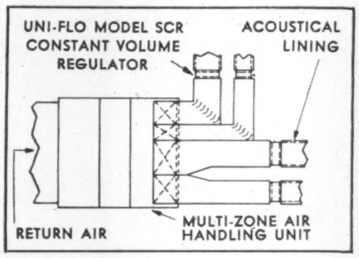

UNI-FLO MODEL SCR CONSTANT VOLUME REGULATOR
ACOUSTICAL LINING
RETURN AIR
MULTI-ZONE AIR HANDLING UNIT

Fig. 4 — Multizone system with SCR regulators in each zone to provide constant cfm delivery.

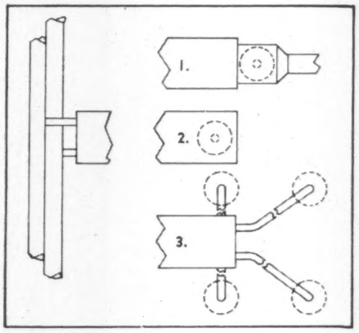


Fig. 5 — Double-duct system illustrating several applications of Model CV control units. Circles indicate ceiling diffusers. (1. CVE open-end unit; 2. CVD with integral diffuser; 3. CVO with octopus outlets.)

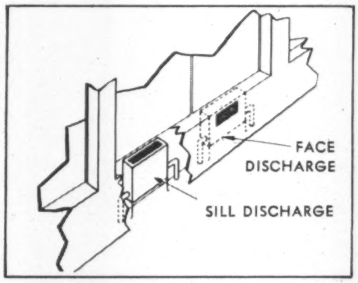


Fig. 6 — Double-duct control unit for under-window mounting. Model SWC furred-in units shown.

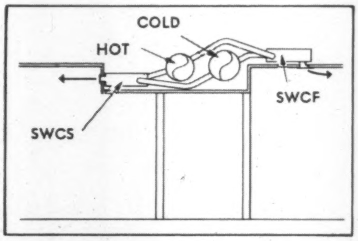


Fig. 7 — Model SWC double-duct control units installed above ceiling for use with ceiling and sidewall diffusers.

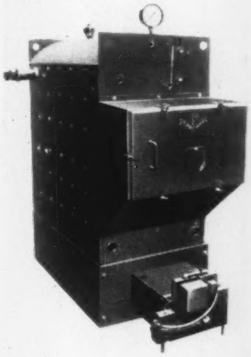
BARBER COLMAN

Uni-Flo

ENGINEERED AIR DISTRIBUTION

BARBER-COLMAN COMPANY

Dept. Q, 1101 Rock Street, Rockford, Illinois



Tankless Water Heater . . .

. . . designed to deliver steady, instant supply of hot water from twin, tankless copper coils—*Portmar Water Heater Co., Inc., Dept. HPAC, 193 Seventh St., Brooklyn 15.*

Gas-fired twin coil volume heater, "WH Series," said to eliminate storage tank. Available in 14 sizes with capacities from 300 to 6000 gph of hot water. Heater produces two hot water temperatures: 140 F for general use; 180 F for sterilizer rinse.

Compressed Air Filter . . .

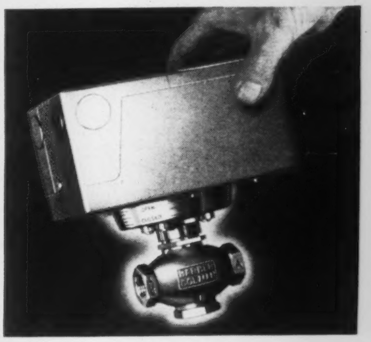
. . . designed to provide high efficiency filtration for compressed air, other gases—*Mine Safety Appliances Co., Dept. HPAC, 201 N. Braddock St., Pittsburgh 8.*

"Air Line Ultra Filter" provides minimum removal of particulate 0.3 micron and larger diameter at rated flows of 99 percent. Maximum operating temperature: 250 F; maximum operating pressure: 125 psig. Special units for operating pressures up to 500 psig also available. Designed for 25 scfm maximum volume, standard unit's initial pressure drop is 0.8 psig. Reducers available to any

NOW...

Electronic Control

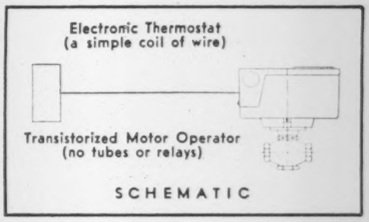
at no extra cost!



. . . new transistorized motor operator for proportional control!

The transistor operator is an electronically controlled device containing a transistorized amplifier and an operating mechanism for proportional operation of a valve (as shown) or damper.

Virtually self-contained, the attachment of a two-wire sensing element forms a complete electronic control system (see schematic). Wide choice of sensing elements.


Electronic Thermostat (a simple coil of wire)
Transistorized Motor Operator (no tubes or relays)
SCHEMATIC

Compactness, simplicity, and moderate cost are achieved through the use of transistors and electronic circuitry. This means superior performance and low maintenance.

Spring-return action provides fail-safe performance.

Ask for Brochure F8991

BARBER COLMAN

Automatic Controls

"Better Control . . . Electrically"

BARBER-COLMAN COMPANY

Dept. Q, 1301 Rock Street, Rockford, Illinois
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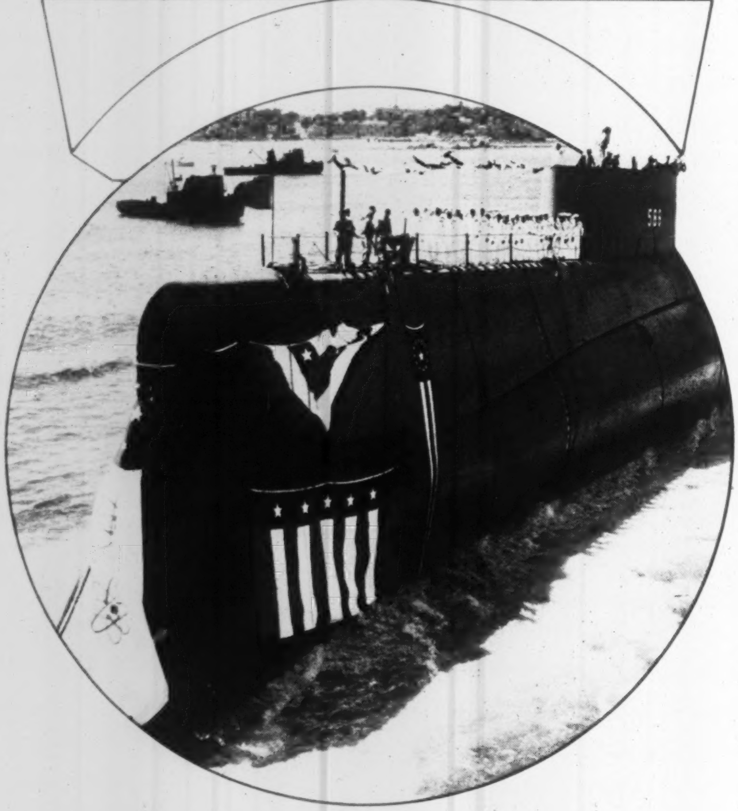
BONNEY WELDOLETS
for the world's biggest
ATOMIC SUBMARINE



TRITON Main Steam Line Branch
Connections **full size** and **reducing** sizes
made with Bonney Weldolet Fittings.

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ELBOLETS®
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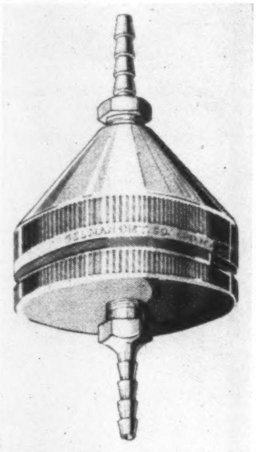
for all services

Bonney Weldolets featuring strength, improved flow conditions and easy, economical installation are used on the atomic-powered TRITON, world's largest and most powerful submarine. Launched in August, 1958 at the Groton, Connecticut shipyard of General Dynamic's Electric Boat Division, this twin-reactored sub—447 ft. long and displacing 5,900 tons—is scheduled for radar picket duty.

For detailed information about all Bonney Welding Fittings, call or write today!

BONNEY FORGE AND TOOL WORKS
ALLENTOWN, PENNSYLVANIA

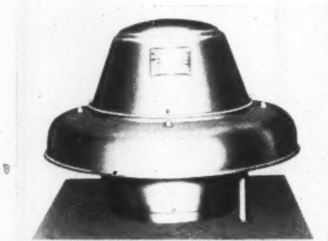
thread desired for lines smaller than filter's ½ in NPT female inlet and outlet.



Stack Sampler . . .

. . . designed to be used to determine dusts, aerosol concentration in smoke stack, process ducts, other closed systems—*Gelman Instrument Co., Dept. HPAC, 233 Jefferson, Chelsea, Mich.*

In use, high efficiency dust filter is inserted in holder and suction is applied to one end. After dust sample is collected, filter is removed; dusts may be determined by weight of microscopic examination. Radioactive aerosols may be determined by removing filter, placing it in counting chamber. Filter holders available in 1, 2, 3 in. sizes. Body of filter constructed of anodized aluminum; support screen is of stainless steel.



Roof Ventilators . . .

. . . manufactured completely of heavy gage aluminum—*Peerless Electric Co., Fan Blower Div., Dept. HPAC,*

OUTLET
EVERLASTING VALVE CO.
EVERLASTING VALVE CO. JERSEY CITY

Less than ¼ turn opens or closes

When you need...

- Quick action
- Leak-Proof Seal
- Minimum Pressure Drop
- Straight-through full flow
- Valves that cannot wedge or jam
- Self-grinding rotating disc

Specify Everlasting Valves

For more information WRITE for these bulletins.

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Everlasting VALVES for General Services
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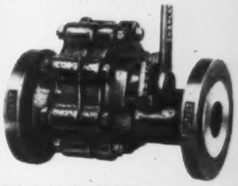
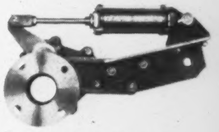
VISCOUS MATERIALS

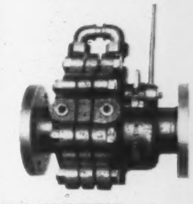
BOILER BLOW-OFF
Quick acting, also handwheel operated "Y" and angle types. For pressures up to 600 psi.



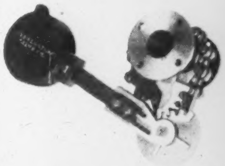
GENERAL SERVICE
Where drop-tight seal and full flow is essential.



CYLINDER OPERATED
Can be remotely controlled, electrically or manually.



STEAM JACKETED
Assures free flow of viscous materials.



WEIGHT-OPERATED
For automatic drains or emergency shut off.

Everlasting VALVES

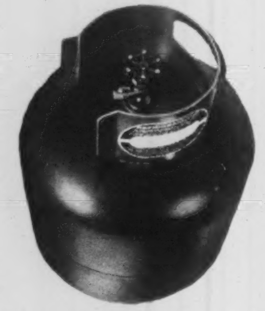
EVERLASTING VALVE CO., 61 FISK STREET, JERSEY CITY 5, N. J.

EV 406

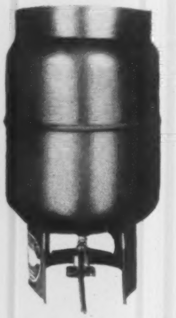
Ask Your Air Conditioning Equipment Manufacturer for —

THE LATEST IN SMALL, LIGHTWEIGHT SERVICE CHARGING CYLINDERS FILLED WITH REFRIGERANT 22

Stock sizes in REFRIGERANT 22 capacities of: 50lb. - 25lb. - 15lb.



Air conditioning equipment manufacturer's brand name and no. shown on label.



Convenient for liquid charging (as shown) as well as gas charging (in standing position).

Stack conveniently to save space.

Check These Many Features:

- RIGID MOISTURE AND QUALITY CONTROL
- Blue Plastic seal on valve outlet is your assurance of maximum dryness quality and purity.
- Seals are printed "MAXIMUM DRYNESS—FACTORY SEALED."
- LESS WASTE BECAUSE OF OVER OR UNDER CHARGE
- Choice of small cylinder sizes to suit each system. (Less cost per cylinder.)
- EASY TO HANDLE — lightweight, small cylinders with built-in hand grips. (50 lb. size only 22 lb. empty.)
- NO HOOD CAPS TO LOSE — Valve protected by permanent collar.
- STACKING RINGS SAVE VALUABLE SPACE
- Valve protection collar also serves as stacking ring. Uniform ring on all sizes enables mixed stacking.
- CAN BE USED IN BOTH UPRIGHT POSITIONS
- Equally convenient for gas or liquid charging.
- No mounting blocks necessary.
- NO VALVE WRENCHES NEEDED — Handwheel already on cylinder valve.
- STANDARD FITTING ALREADY ON VALVE
- Sturdy cylinder valve complete with flare nut ready for charging connection to standard 5/16 O.D. tubing. Also adapter to fit $\frac{1}{4}$" flare female connection supplied at no charge.
- YOU CAN DELIVER AIR CONDITIONING SYSTEM COMPLETE WITH FULL REFRIGERANT CHARGE ANY TIME OF THE YEAR
- NO FREIGHT OR DEPOSIT PROBLEMS ON CYLINDERS
- Prices include freight on full cylinders and on return of empties.
- No cylinder records needed—deposit of $12.00 each for all three sizes of cylinders refunded regardless of cylinder number.

ASK FOR THE *BLUE* CYLINDER WITH THE PROTECTING STAND RING

Air Conditioning Equipment Manufacturers Send Inquiries to:

PENNSYLVANIA ENGINEERING CO.

1107-21 NORTH HOWARD STREET PHILADELPHIA 23, PENNA.

Patent Applied for

1401 *W. Market St., Warren, Ohio.*

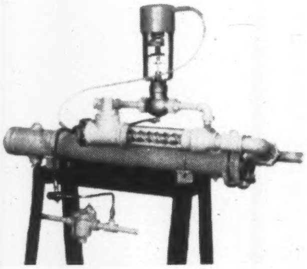
Direct drive aluminum spun roof ventilators available in wheel diameters from $7\frac{3}{4}$ to 15 in. and capacities from 138 to 2950 cfm. Units direct-driven with permanent split-capacitor type motors wound for 115 volt, 60 cycle, single phase current.

TACO
HOT
MIX
COLD
PAT PEND

Tempering Valves . . .

. . .developed for mixing hot, cold water to desired temperatures—*Taco Heaters, Inc., Dept. HPAC,* 1160 *Cranston St., Cranston* 9, *R. I.*

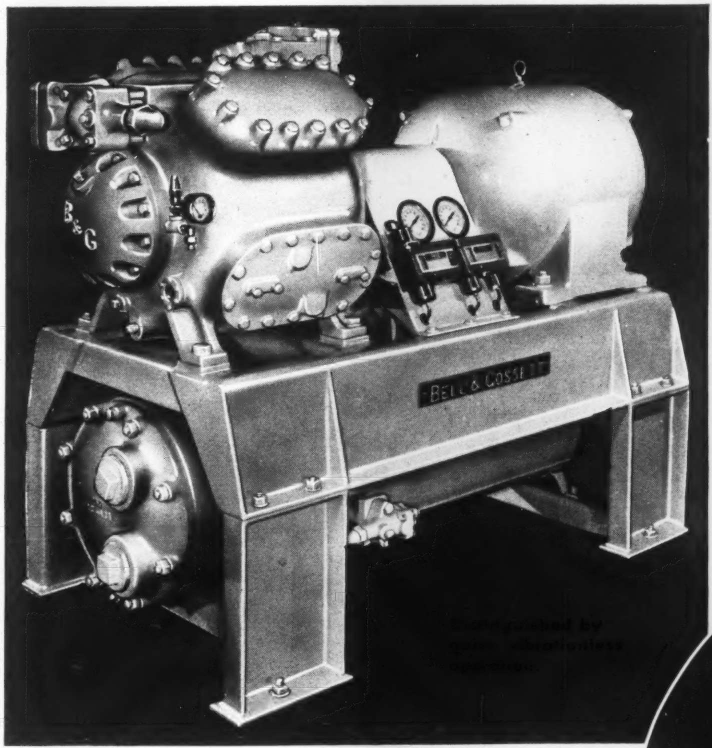
"No. 518" and "No. 519" tempering valves have following features as cited by manufacturer: threaded connections; all bronze and stainless steel construction; hermetically sealed thermostatic element. Both models have temperature range of 120 to 160 F and are available with $\frac{1}{2}$ in. threaded connections.



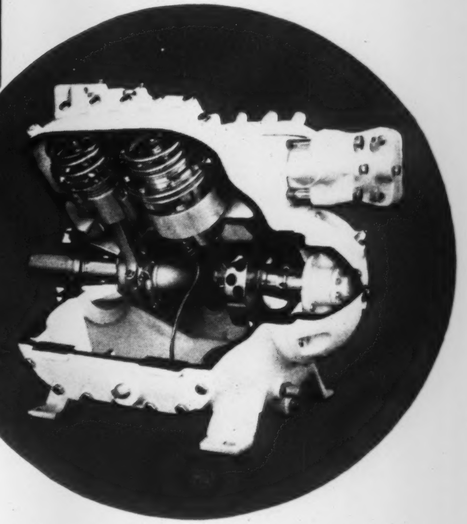
Steam Fluid Heater . . .

. . .incorporates thermostatic regulator bulb in heated fluid discharge line—*Fulton Sylphon Div., Robertshaw-Fulton Controls Co., Dept. HPAC, Box* 400, *Knoxville* 1, *Tenn.*

Use of thermostatic regulator bulb with balanced single seated valve said



AN ACHIEVEMENT IN COMPACT, *QUIET* EFFICIENCY... WITH ALL MAJOR PARTS MADE AND GUARANTEED BY BELL & GOSSETT COMPANY


Cut-away view of Condenser Compressor

B&G CONDENSING UNIT

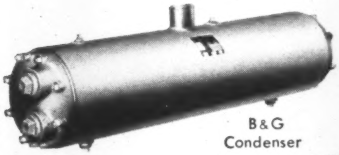
There are numerous, well-defined reasons why this B&G Condensing Unit is the outstanding buy in air conditioning and refrigeration equipment. An impressive list of features, many of them exclusive, are engineered into the shortest unit on the market today—with capacities ranging from 7½ through 150 tons.

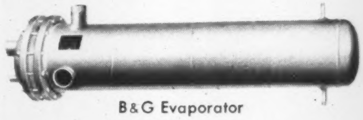
Not the least of the reasons is the fact that all major components are built in the B&G plant—*hence covered by a single manufacturer's guarantee!*

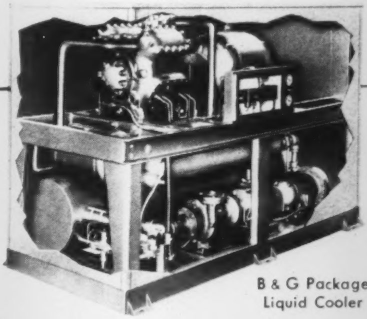
The B&G Package Liquid Cooler is another matched unit—a completely integrated and assembled water chiller. In capacities from 7½ through 150 tons, the components of this chiller give a complete capacity-engineered combination of chassis, motor, compressor and automatic control obtainable nowhere else. Everything included—no extras to buy.

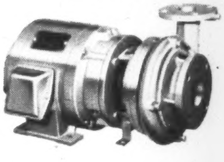
Send for descriptive literature and engineering data.

A FULL LINE OF REFRIGERATION AND AIR CONDITIONING COMPONENTS


B&G Condenser


B&G Evaporator


B & G Package Liquid Cooler


B&G Centrifugal Pumps

Reg. U.S. Pat. Off.

BELL & GOSSETT COMPANY

Dept. RFS-5, Morton Grove, Illinois

Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

CHECK *the Advantages of* GOODALL *Rubber* EXPANSION JOINTS

Goodall Expansion Joints have not only the advantages stemming from the natural characteristics of rubber for all types of installations, but, what's more important, they have back of them Goodall's engineering skill, manufacturing experience and reputation for quality that give *added* assurance of exceptional service under all conditions.

EASIER TO INSTALL...

Goodall Rubber Expansion Joints are quickly, easily installed on new construction or as replacements. They are light in weight to facilitate handling, with short face-to-face dimensions for easier application where space is limited. Retaining rings are quickly aligned and bolted. No gaskets are required.

RESPONSIVE TO MINIMUM PRESSURE...

With Goodall Rubber Expansion Joints only the slightest pressure is required to create movement in any direction. Result—stress on metal pipe or other member is eliminated or, at most, reduced to an absolute minimum.

MANY SIZES...HIGH WORKING PRESSURES...

Goodall Rubber Expansion Joints are available in sizes from 3/8" to 96" I.D., in all required styles and constructions. Working pressures range up to 125 P.S.I. for Pressure Joints, and to 90 P.S.I. for Vacuum-Pressure Joints, depending on size.

LONGER SERVICE LIFE...

Goodall Rubber Expansion Joints last longer in service because of inherent characteristics of the material from which they are made. There is no embrittlement ... continuous movement (flexing) actually keeps the rubber joint "alive". There is no corrosion or electrolysis. Resistance to abrasion is exceptionally high. Replacement costs are lower.

"If it's GOODALL, it MUST be Good"

Contact Our Nearest Branch or Write for Catalog

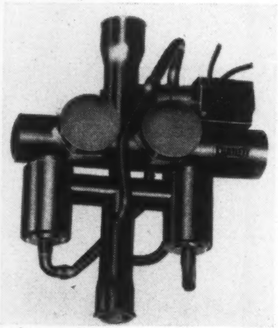
Standard of Quality—Since 1870

HOSE • BELTING • FOOTWEAR • CLOTHING
AND OTHER INDUSTRIAL RUBBER PRODUCTS

GOODALL *Rubber Company*

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.
BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES.
IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

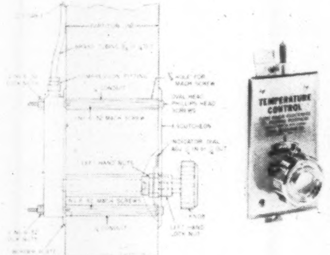
to prevent excessive temperature buildup in heater on long standby periods. "Instantrol" steam-fluid heater unit consists of heater regulator with bulb, steam strainer, mechanical steam trap, discharge thermometer, other fittings. Capacity ranges from 2 gpm with 5 psi steam pressure to 55 gpm with 20 psi steam. Water temperature can be controlled at settings from 110 to 170 F.



Reversing Valve . . .

. . . with 15 to 20 ton capacity—*Chatleff Valve & Mfg. Co., Dept. HPAC, P. O. Box 996, Austin, Texas.*

"Model CR-770" reversing valve said to have full seating with plastic against brass. Valve is designed for operations in refrigeration systems of any temperature from comfort to process applications.



Damper Regulator . . .

. . . designed for remodeling work—*Young Regulator Co., Dept. HPAC, 20910 Miles Ave., Cleveland 28.*

"No. 710" remote control damper regulator is capable of operating one or two dampers at a distance of 250 ft. Knob, plate placed flush against wall; extended shaft allows mecha-

Campbell

WARM AIR HEATERS FOR LARGE BUILDINGS

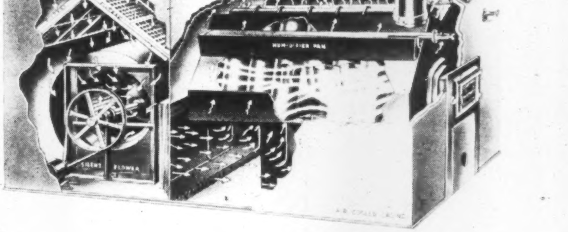
Public School, Noonan, N. D. heated with a single stoker-fired Campbell 8000 Series Heater. Architects, Wells & Denbrook, Grand Forks, N. D.; Heating contractor, Western Sheet Metal Co., Minot, N. D.

WARM AIR HEATING FOR SCHOOLS

The economy and practicability of Campbell Warm Air Heaters for large multiple-room buildings has been repeatedly demonstrated, even in the coldest climates. Campbell Heaters give you all of the advantages of warm air heating with relatively easy installation and surprisingly low cost. When you think of warm air heating, think of Campbell. Units for all fuels in capacities up to 3,150,000 BTUs.

MANUFACTURERS' AGENTS:

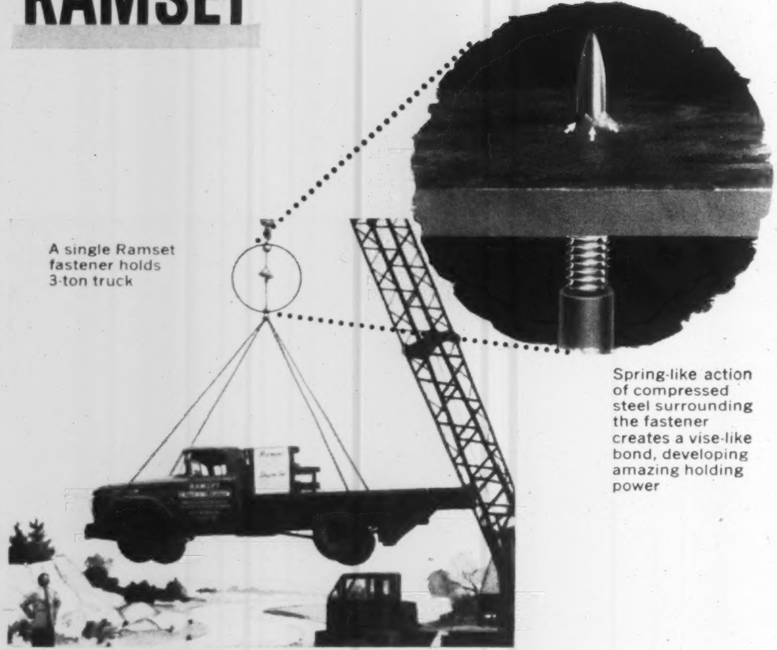
We have some very attractive openings for men calling on heating contractors and architects.



CAMPBELL
HEATING COMPANY

DES MOINES 17, IOWA

ONLY
RAMSET



A single Ramset fastener holds 3-ton truck

Spring-like action of compressed steel surrounding the fastener creates a vise-like bond, developing amazing holding power

Ramset holding power test conducted by The Austin Co., engineers and builders, Cleveland, Ohio

offers austempered fasteners with
such superior holding power

Even under the most demanding workloads, Ramset's austempered Red-Tip fasteners assure more holding power and greater fastener strength. Austempering, Ramset's high-heat slow-quench treatment, puts extra strength, toughness and dependability into every Ramset Red-Tip fastener.

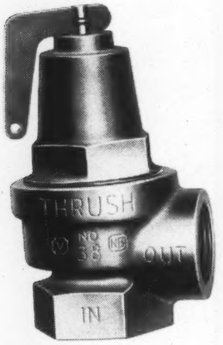
Ramset's wide variety of fastener sizes puts the *right* fastener on each job—you don't have to "make-do" with off-size pins or studs. Ramset assures positive, guaranteed fastenings into tough steel, concrete or masonry faster and easier, and at lower in-place cost. Consider Ramset's many advantages and the "100-for-100" guarantee—call your Ramset dealer (under "Tools" in Yellow Pages) for details.

In addition to powder-actuated fastening, the versatile Ramset System includes Shure-Set® hammer-in tools for light fastening, and Ringblaster® heavy-duty kiln gun.

Ramset® Fastening System

WINCHESTER-WESTERN DIVISION · OLIN MATHIESON CHEMICAL CORPORATION
12109-E BEREA ROAD · CLEVELAND, OHIO

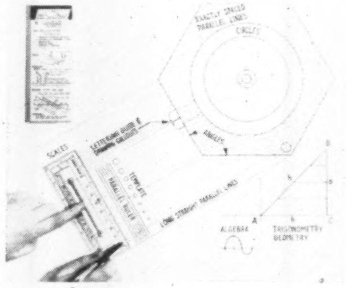
nism, border plate, tubing to be installed without channeling of plaster for tubing, or plaster patching for remote control unit. Furnished in sizes for partitions from 2 to 8 in. thick.



Relief Valve . . .

. . . designed to operate as water relief valve, but also relieves steam conditions—*H. A. Thrush & Co., Dept. HPAC, Peru, Ind.*

"No. 38" low pressure relief valve has all brass working parts and heat resistant, non-sticking, silicone seat. Valve designed for positive shutoff after discharging; heat resistant diaphragm protects spring from water corrosion. Available with $\frac{3}{4}$ in. inlet and $\frac{3}{4}$ in. outlet.



Drawing Instrument . . .

. . . designed to do jobs of protractor, compass, ruler, parallels, and angles—*Smith-Drake Corp., Dept. HPAC, 1206 S. La Brea, Inglewood, Calif.*

"Proco-Rule" has set of gripping wheels in plastic body, permitting instrument to roll and still hold exact alignment, says manufacturer, which

for

SPECIFICATION

and

BUYING INFORMATION

Use your complete, up-to-date

JANUARY DIRECTORY ISSUE

Your job will be a lot easier if you'll keep the January Heating Piping & Air Conditioning constantly available for handy reference. It's one of your most valuable tools — one which will save you many hours of looking up the products you need for your various jobs. It's the ONE complete, up-to-date, readily accessible source of product information on who makes boilers, tools, controls, etc., you need — and where they're located. They're identified by trade names, too. EVERY product is listed, alphabetically arranged and printed on a distinctive yellow stock for easy reading and reference.

Keep it handy . . . the time you save with it can be used to advantage in other ways.

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196 Pages — 8½" x 11" — $1.50

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

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KEENEY

PUBLISHING COMPANY

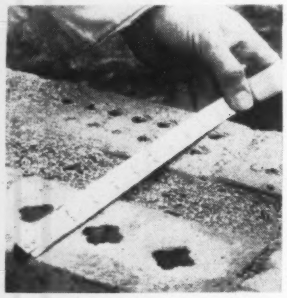
6 North Michigan Ave. Chicago 2, Illinois

gives easy action in drawing circles, parallel lines, angles. Instrument is 6 × 2 in. in size; made of clear, green plastic.

Solenoid Valve . . .

. . . designed for water control in fan-coil units, using forced circulation chilled or hot water for individual station air conditioning—*Jackes-Evans Mfg. Co., Dept. HPAC, 4427 Geraldine Ave., St. Louis* 15.

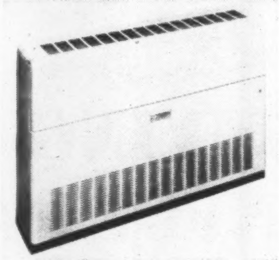
"J-E, Type 701" 3-way solenoid valve said to provide accurate control of temperature in place of ordinary heating, cooling. Capacity range is from ½ gpm with maximum operating pressure of 25 psi. Solenoid utilizes pilot operation, diaphragm amplification, said to provide maximum flow at low pressure and eliminate fluid hammer, electrical hum. Technical bulletin gives details.



Masonry Insulation . . .

. . . said to have high resistance to moisture, heat transfer—*Zonolite Co., Dept. HPAC, 135 S. LaSalle St., Chicago* 3.

Water-repellent masonry fill insulation is free-flowing granular material (vermicultite). May be used with block and cavity walls. Said to resist water, reduce heat loss 50 percent.



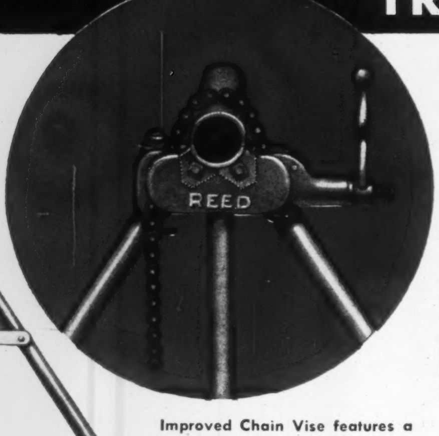
Electric Cabinet Heaters . . .

. . . designed for maximum flexibility of arrangement and operation—*Ilg Electric Ventilating Co., Dept. HPAC, 2850 N. Pulaski Rd., Chicago* 41.

Included in "Series AE" electric cabinet heater line are two blow-through models with direct-drive fan assemblies and a draw-through unit with V-belt driven fan assembly. Units available for floor, ceiling, wall, or inverted mounting. Manual, pneumatic, and automatic electric controls available.

REED PORTABLE *Folding Tray* TRIPOD VISES

Patented folding tray locks legs solidly to end spring and recoil. Tripod folds compactly for convenient, one-hand carrying. Sets up or takes down easily.



Improved Chain Vise features a convenient side handle which ends fumbling or skinned knuckles. Capacity from ⅛" to 4" makes it ideal for construction or maintenance work.

Now available with a new and better Chain Vise or the long-jaw Yoke Vise

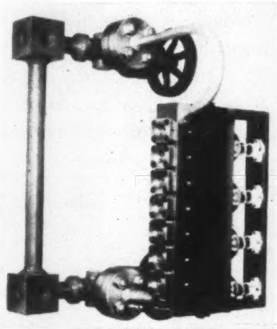
Reed Folding Tray Tripods are well known for their work-saving solidity and the ease with which they can be carried, set up or taken down.

The Chain Vise Model is easy and convenient to use because the handle is at the side where you can turn it easily and naturally. The chain drops into position even on 4" pipe. You never have to hold it with one hand while you tighten with the other. Hardened vise jaws have three faces for triple life.

The Yoke Vise Model features the patented Reed long-bearing alloy steel jaws which provide a "wrench" action . . . so that a slight handle pressure holds any pipe from ⅛" to 2½". Reversible lower jaws. Special features to end lost motion.

Ask your jobber or write for free literature.

REED TRADEMARK
MANUFACTURING COMPANY
ERIE, PENNSYLVANIA - U. S. A.



Water Level Gage . . .

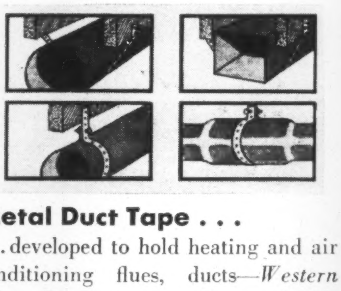
. . .designed for boilers operating at pressures to 1050 WSP—*Yarnall-Waring Co., Dept. HPAC,* 107 *Mermaid Ave., Philadelphia* 18.

Design of water level gage is individual port type with cover plate assemblies that can be serviced with gage in place. Two color readings: steam shows red; water shows green. Ranges of visibility are 13, 15½, 18 in.

Industrial Insulation . . .

. . .of rigid board type—*Keasbey & Mattison Co., Dept. HPAC, Butler Ave., Ambler, Pa.*

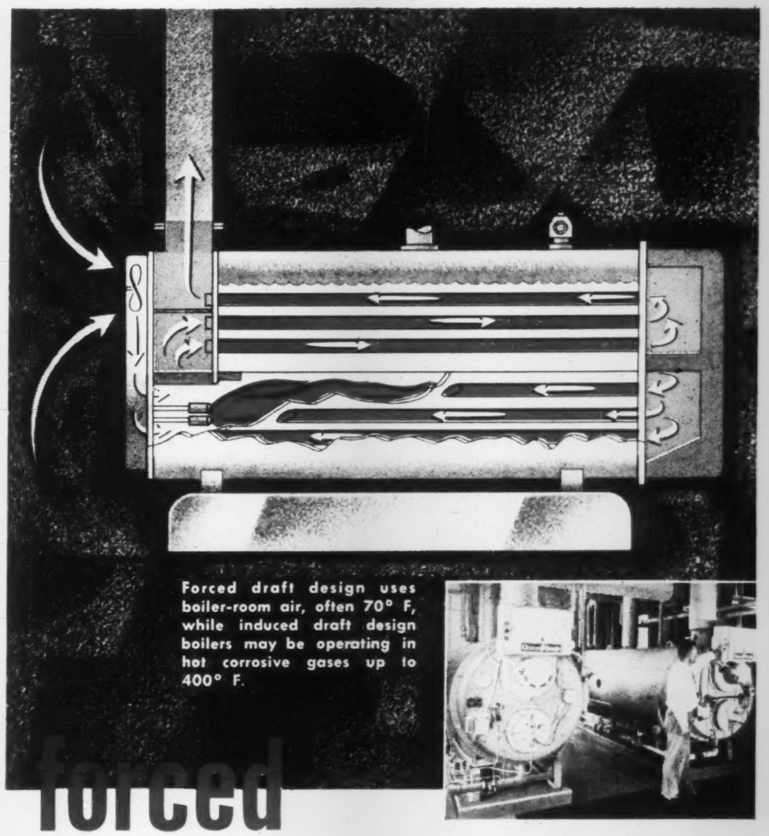
"K-Board" said to offer low thermal conductivity and low density. Available in sheets 42 × 48 in. with thicknesses of ⅛, ¼, ⅜, and ½ in. Asbestos fibers combined with incombustible, chemically inert ingredients and pressure-formed into sheet. Said to be especially suitable for ceilings, walls, floors in buildings where equipment generates high temperatures. Insulation will withstand soaking heat of 1200 F maximum.



Metal Duct Tape . . .

. . .developed to hold heating and air conditioning flues, ducts—*Western Wire Products Co., Dept. HPAC,* 1431 *S. 18th St., St. Louis* 4.

Perforated "Ductape" can be used



Forced draft design uses boiler-room air, often 70° F, while induced draft design boilers may be operating in hot corrosive gases up to 400° F.

forced draft design:

How Cleaver-Brooks packaged boilers use cool air to heat more efficiently

FORCED DRAFT DESIGN PROVIDES positive draft with a vibration-free fan, delivering cool, clean boiler room air for combustion at constant density and volume. Efficient combustion, clean fire and stable flame are assured through air-fuel ratios automatically controlled and balanced for a modulating fire, and to meet varying load demands. No high chimney or large diameter breeching are required; only a simple vent is needed.

Since the forced draft fan moves only cool, clean boiler room air, it is never exposed to the sooting and corrosive effects of hot gases; it requires little maintenance and is lower in initial cost.

4-PASS FIRE TUBE DESIGN squeezes maximum heat out of every fuel unit . . . maintains high flue-gas velocity . . . assures optimum heat transfer.

UPDRAFT CONSTRUCTION with low furnace keeps hottest gases well below water level for safe operation.

5-SQ. FT. OF HEATING SURFACE per boiler hp for top heat transfer, prolongs boiler life, assures greater efficiency and lower maintenance.

This exclusive combination of Design Standards is the key to the superiority of Cleaver-Brooks packaged boilers — 15 to 600 hp, 19 sizes, 130 models; steam or hot water; oil, gas or combination oil/gas fired; parts and service available anywhere in the U.S. and Canada.

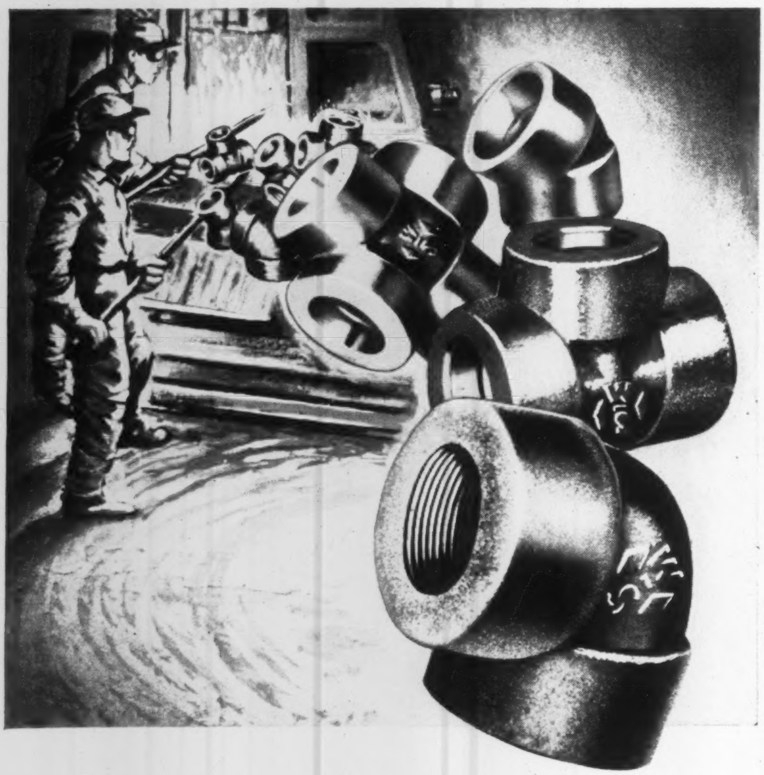
For details, contact our representative or write Cleaver-Brooks Company, Dept. F, 313 E. Keefe Avenue, Milwaukee 12, Wisconsin.

Cleaver Brooks

ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

W-S Drop Forged from Solid Billets...

FORGED STEEL FITTINGS



Heat . . . pressure . . . turbulence . . . oxidation . . . vibration . . . reduction . . . shock. For critical installation problems like these, get maximum protection with W-S Carbon, Stainless and Alloy Steel Fittings.

- Drop forged to produce exceptionally high tensile and impact strength.
- Long accurate threads, in perfect alignment, for ease of installation.
- Heavy uniform fitting wall thickness—an important safety factor.
- Accurate machining to fit tight.

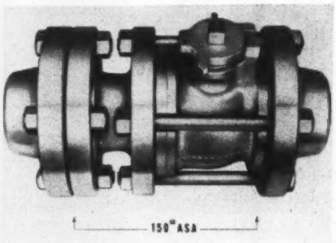
For your next order, call your nearby W-S Distributor. You'll find him ready with comprehensive stocks of the complete line of W-S high-quality fittings. *Forge & Fittings Division, H. K. Porter Company, Inc., Box 95, Roselle, New Jersey.*

FORGE AND PORTER FITTINGS DIVISION

H.K. PORTER COMPANY, INC.

Divisions: Connors Steel, Delta-Star Electric, Disston, Forge & Fittings, Leschen Wire Rope, Mouldings, National Electric, Refractories, Riverside-Alloy Metal, Thermoid, Vulcan-Kidd Steel, H. K. Porter Company (Canada) Ltd.

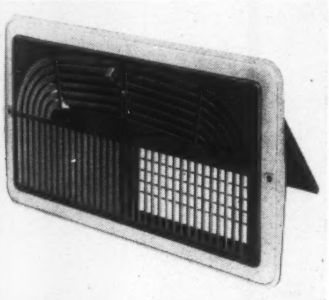
with either bolts or nails. The 24 gage galvanized 3/4 in. wide tape is available in coils of 10, 25, 50, and 100 ft in bulk and in coils of 25, 50, and 100 ft in self-dispensing boxes.



Flange Ball Valve . . .

. . . designed for limited space applications—*Worcester Valve Co., Inc., Dept. HPAC, 16 Parker St., Worcester, Mass.*

"Econ-O-Miser" flange ball valve designed to serve as 150 lb or 300 lb valve where conditions do not require valve of ASA dimensions. With addition of "spacer", valve becomes 150 lb or 300 lb ASA valve. With various combinations of seats, O-rings, body materials, unit can accommodate many types of media within pressure-temperature limitations of sealing materials.



Air Diffusers . . .

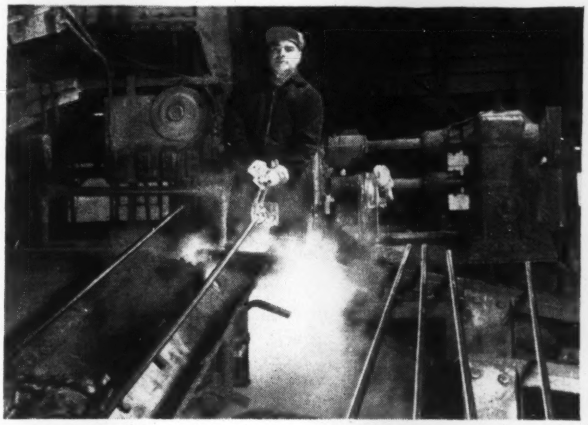
. . . with four way air pattern control—*Air Control Products, Inc., Dept. HPAC, Coopersville, Mich.*

Fins on new "No. 25" sidewall and "No. 26" baseboard perimeter diffusers are factory set to provide air pattern for typical sidewall perimeter diffuser locations. Vertical, horizontal fins adjustable, allowing necessary air pattern adjustments. Offered in sizes 10 × 6 in. and 12 × 6 in.

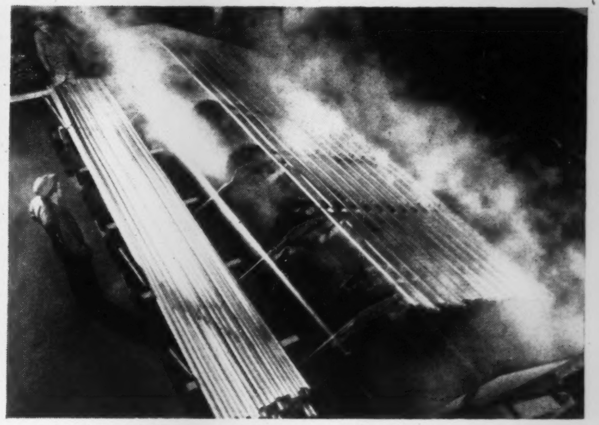
These 4 steps show why SPANG brings you the best galvanized steel pipe!

THOROUGH CLEANING of the pipe before galvanizing removes all dirt, grease and scale, leaves a clean surface for the prime western zinc galvanized finish.

STEAM-WIPING of the pipe's exterior, as it comes from the kettle through an air ring, produces a smooth even finish that will stand up under rough usage.



SUPERHEATED STEAM blown through the pipe interior removes excess zinc inside, assures a smooth uniform surface for easy flow of liquids.



QUICK QUENCHING of the pipe in a sodium dichromate solution bonds the galvanized finish to the steel, adds extra service to the life of the pipe.

This is just part of the *quality-control* processing that each length of Spang Steel Pipe receives. Careful control from skelp through the inspection tables assures you of a *top-quality* pipe for *top-quality* installations. Next job, make it steel pipe . . . make it Spang! Your local Spang Distributor is at your service!

THE NATIONAL SUPPLY COMPANY

SPANG® CW® STEEL PIPE

Subsidiary of Armco Steel Corporation ARMCO

TWO GATEWAY CENTER, PITTSBURGH, PA.

With these 3 RIDGID®

Jam-Proof Pipe Threaders

my power drive threading is Safe...

...no watching to keep them from jamming

...save me a lot of time, too!

1" to 2" Pipe RIDGID 65R-TC

Jam-proof—can't jam if you forget it . . . Threads 4 sizes of pipe and conduit with 1 set of dies . . . True-Centering workholder—no more crooked threads—but adjustable for drip threads. Far more for your money—compare!

2½" to 4" Pipe RIDGID 4PJ

Jam-proof . . . drive pinion kicks out automatically—real safety when power threading. Workholder sets to size before putting on pipe. Other exclusive advantages. Special 4PJ for conduit.

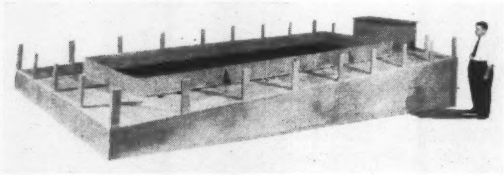
4" to 6" Pipe . . . RIDGID 161

Jam-proof for safe power threading. 1 set of dies threads 4", 4½", 5" and 6" pipe and conduit—sets to size fast. Workholder sets to size before putting on pipe, a work-saver feature. Many other reasons why the 161 is your best buy!

See and try these popular RIDGID Threaders . . . at your Supply House.

The Ridge Tool Company Elyria, Ohio, U.S.A.

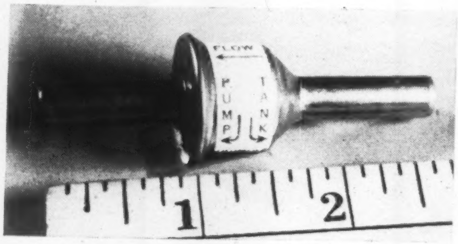
THREADED PIPE . . . It's Tight . . . It's Best . . . Costs Less!



Ventilating Hoods . . .

. . .developed to provide maintenance free operation —*Ceilcote Co., Dept. HPAC,* 4967 *Ridge Rd., Cleveland* 9.

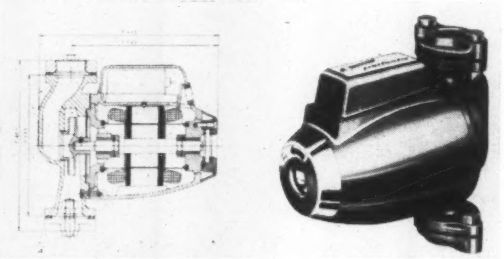
"Duracor" magnesium thorium etch tank hood said to provide high strength at high temperatures, require no painting, lining, other maintenance. According to manufacturer, hood withstands fumes from solution of sulphuric acid, sodium nitrate, and acetic acid. "Series 3000" operates at temperature of 160 F. Slotted hood draws off fumes from all four sides at rate of 14,000 cfm, exhausts them through riser. Unit measures 23 × 11 ft.



Vacuum Check Valve . . .

. . .designed for application to any vacuum and low pressure system—*Eynon-Dakin Co., Dept. HPAC,* 9900 *Freeland Ave., Detroit* 27.

New vacuum check valve has operating range from −40 to 280 F. Design said to be such that any type end fittings may be assembled to basic unit.



Circulating Pump . . .

. . .lubricated by system water, with no oiling, greasing required—*Taco Heaters, Inc., Dept. HPAC,* 1160 *Cranston St., Cranston* 9, *R. I.*

"Perfecta" circulating pump has following features as cited by manufacturer: no seals or packing; no drive coupling; no starting switch; one-piece cast impeller. Available with ¾, 1, 1¼, or 1½ in. flanges.

TOTAL COVERAGE

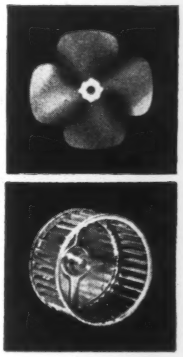
No matter which way the wind blows with your blower unit requirements – belt-driven, direct drive or radial-axial mixed flow – Torrington has the solution to your problems.

This means complete technical data and the proved-out performance rating on three lines of basic blower unit designs.

In addition to the standard direct drive units and the already famous VariBasic belt driven series, latest and most spectacular addition is the exclusive Radiax unit, combining the optimum performance characteristics of both radial and axial flow techniques.

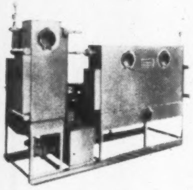
The result is FULL COVERAGE – the best "problem insurance" you could have.

Talk to Torrington!



THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO



KATHABAR® SYSTEMS

Give these advantages to specifying engineers:

STERILE AIR

Now you can design spaces to maintain air sterility as scientifically as temperature and humidity. Only Kathabar enables you to calculate bacteria gain and maintain design limits of 5 micro-organisms per 10 cu. ft. or less, continuously.

FROST-FREE COOLING

Get continuous air supply at dry bulbs and dew points way down to −90 F. No freeze-ups... no fluctuating efficiency... no defrosting shutdowns... no duplicate sets of coils. Cool better; fewer tons. Proved in candy cooling... photo film chilling... brewing... chemical processing... environmental testing... many other applications.

GET FACTS

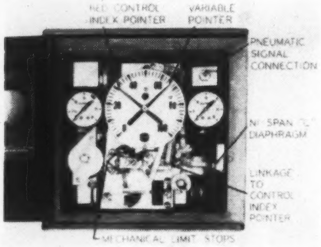
Surface

SURFACE COMBUSTION CORPORATION
2384 Dorr Street, Toledo 1, Ohio
Send facts on Kathabar systems for following application:
....
....
name & title..
company...
street...
city..............................*zone*.......*state*...................

59-2E

EQUIPMENT DEVELOPMENTS

Continued



RED CONTROL INDEX POINTER
VARIABLE POINTER
PNEUMATIC SIGNAL CONNECTION
NI-SPAN "C" DIAPHRAGM
LINKAGE TO CONTROL INDEX POINTER
MECHANICAL LIMIT STOPS

Pilot Controller . . .

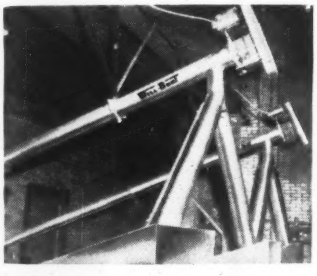
. . . for use with 3 to 15 psi pneumatic signal—*U. S. Gauge Div., American Machine & Metals, Inc., Dept. HPAC, Sellersville, Pa.*

New optional feature on company's line of indicating pilot controllers suits instrument for adjustment of remotely located controller's set point from centralized control panel by manual pneumatic loading station. Said to be accurate, inexpensive "program control." "Pneumatic Set" available with measuring elements for temperature, pressure, liquid level, or flow with various types of pneumatic control action.

Surface Thermometers . . .

. . . developed for accurate measurement of temperature from −328 to 845 F—*Atkins Technical, Inc., Dept. HPAC, 709 Marion Bldg., Cleveland 13.*

Electronic thermometers in "Thermophil" line give response of 0.72 sec in liquids and 2.2 sec on surfaces. Full reading responses are 5 and 15 sec, respectively. Each instrument in line has three or four overlapping scales, depending on model. Readability is 1/4 F or better on standard models.



Coal Conveyor . . .

. . . with two-way, switch-controlled motor drive—*Will-Burt Co., Dept.*

FICTION and FACT

FICTION:

It costs less to buy replaceable filters and throw them away when dirty than to have permanent filters cleaned.

FACT:

R P Washable Industrial Filters can be cleaned 10 times annually for under $4.00 per year (including odor-removing adhesive and depreciation on filter).

ALUMALOY INDUSTRIAL
RP
FOR BEST RESULTS

RP®

Multi-Velocity Industrial
AIR FILTERS

R P Multi-Velocity Industrial Air Filters are designed with ease and economy of operation in mind. Their strong, rugged aluminum construction increases service life—makes them fast, easy and safe to handle—reduces operating costs. Important additional savings too, by eliminating the need for heavy structural design in filter bank construction.

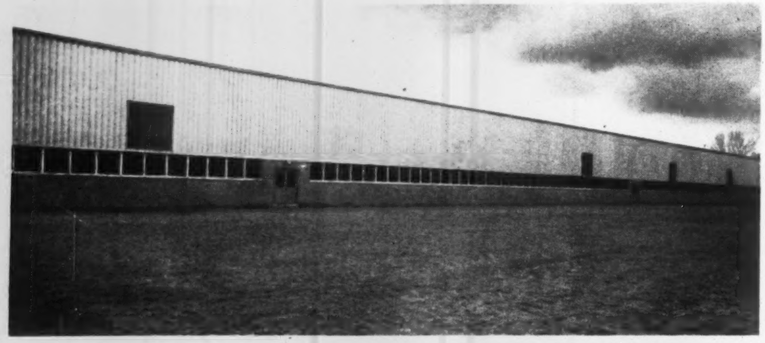
These high efficiency, multi-velocity filters meet all specifications for permanent-type washable filters—with the plus feature of ODOR REMOVAL through the use of R P Super Filter Coat—the water soluble dirt *and odor* removing adhesive, with the "built-in" detergent. *Write for information.*

RP *Products of Research*

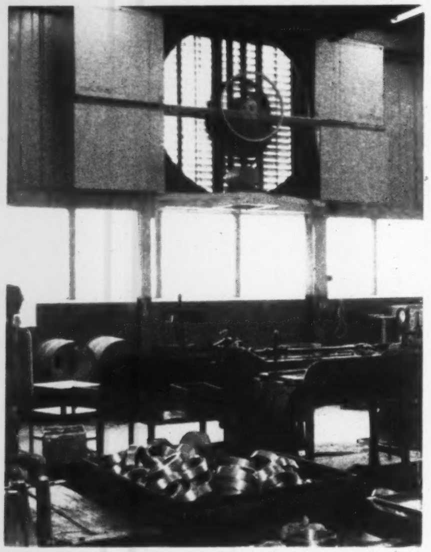
RESEARCH PRODUCTS *Corporation*
Dept. 46, Madison 10, Wisconsin

NOW —

Comfortably Cool in Summer



Coolair
Fans
did
the
job



This Fafnir Bearing plant in Newington, Conn., is an excellent example of how Coolair ventilating fans can make summer working conditions comfortable. They also keep the atmosphere free from fumes and smoke all year long.

Of importance to management is the fact that Coolair ventilating systems are installed in two weeks or less — in either new or existing buildings. And Coolair equipment is economical to operate — no water, no ducts. For complete information, write for Handbook on Commercial and Industrial Breeze Conditioning Systems. Sales offices in all principal cities.

SEE OUR CATALOG IN SWEET'S
INDUSTRIAL CONSTRUCTION FILE

American Coolair Corporation
P. O. Box 2300, Jacksonville 3, Florida

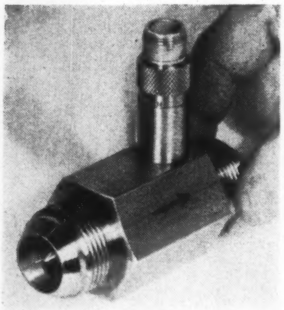
Charter Member Air Moving and Conditioning Association, Inc.

EQUIPMENT DEVELOPMENTS

Continued

HPAC, Orrville, Ohio.

Coal screws and flanged coal screw housings of conveyor made in matched sections to operate at any angle, with single or dual discharge chutes. Standard capacity is 2500 lb per hr.



Turbine Flowmeters . . .

. . .in new redesigned line—*George L. Nankervis Co., Dept. HPAC, 15400 Fullerton Ave., Detroit 27.*

New "Cox Type 20" turbine flowmeters measure liquid flow with ± 1 percent accuracy at pressures to 5000 psi and temperatures from −455 to 1000 F, viscosity permitting. Flowmeters developed to handle jet fuel, oil, gasoline, water acid, alkali chemicals, other liquids with pressure drop of less than 5 psi at maximum flow.

Westinghouse
TEMPERATURE
Limitemp

Temperature Control . . .

. . .combining magnetic amplifier and transistor circuitry—*Westinghouse Electric Corp., Dept. HPAC, 356 Collins Ave., Pittsburgh 6.*

"Limitemp TM" indicating tem-

SINCE 1905

U.S. FLEX

*U.S. REG. T.M.

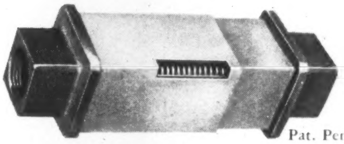
KEFLEX

Stainless Steel Bellows Type
Expansion Compensators
Braided Bronze Flexible Connectors

KEFLEX

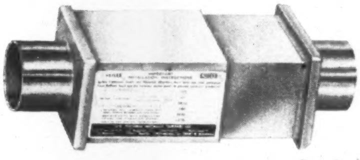
*U.S. REG. T.M.

TYPE 7 Q WITH BRASS FEMALE THREADED ENDS
Maximum Pres. 300 PSI Maximum Temp. 800 F

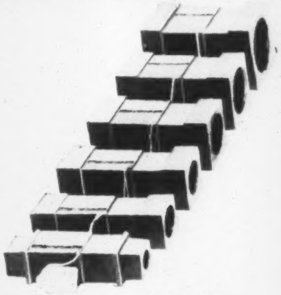


Pat. Pend.

TYPE 7Q-T WITH COPPER TUBE ENDS
Maximum Pres. 200 PSI Maximum Temp. 300 F

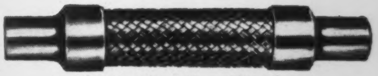


Pat. Pend.



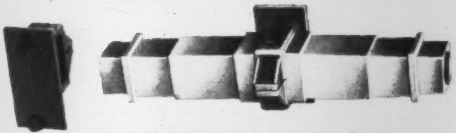
7 Q QUADRA-SIDE EXPANSION COMPENSATORS

"BMH" Flexible Connector



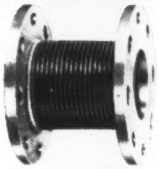
"USF" Vibration Absorber

KEFLEX 7Q FINTUBE Assembly



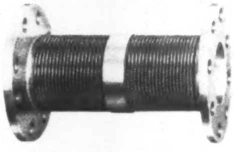
DUAL KEFLEX 7Q With Anchor Base

KEFLEX EXPANSION AND VIBRATION ASSEMBLIES



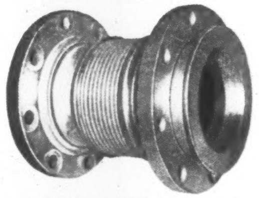
SLOTTED BOLT HOLES

158-12E EXPANSION JOINT

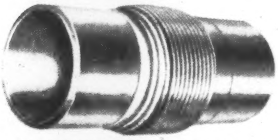


158-15-12E DUAL EXPANSION JOINT

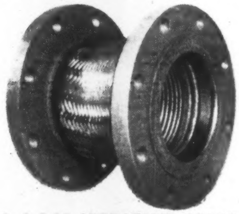
158-15-9E DUAL EXPANSION JOINT



308-14E EXPANSION JOINT

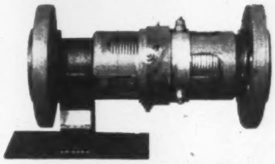


151-2V VIBRATION ABSORBER

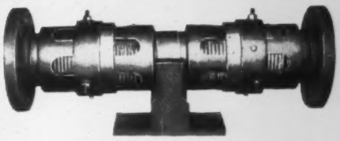


301-4-14S VIBRATION ABSORBER

KEFLEX With KETROL GUIDES
Pat. Pend.

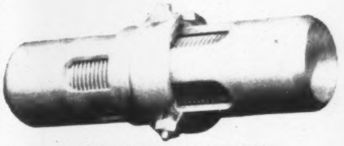


KTO-300-EAB-14E

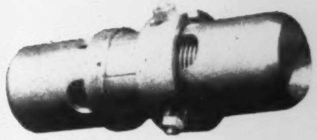


KTO-300-15-CAB-14E

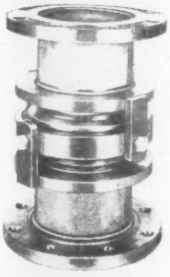
OUTSIDE GUIDES CAGE CONTROLLED



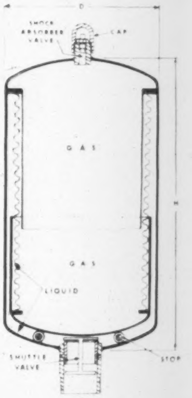
KTO-300-2E EXTENDED



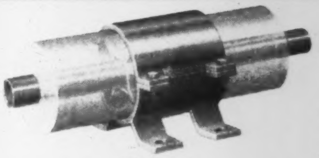
KTO-300-2E COMPRESSED



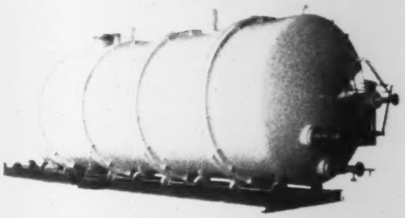
KEFLEX GIMBAL UNIT



TYPE P
KEFLEX PULSCO SHOCK TRAP



TYPE M
KEFLEX MAVE PIPE GUIDE



KEFLEX BELLOWS ON LOX TANK For Vacuum Service

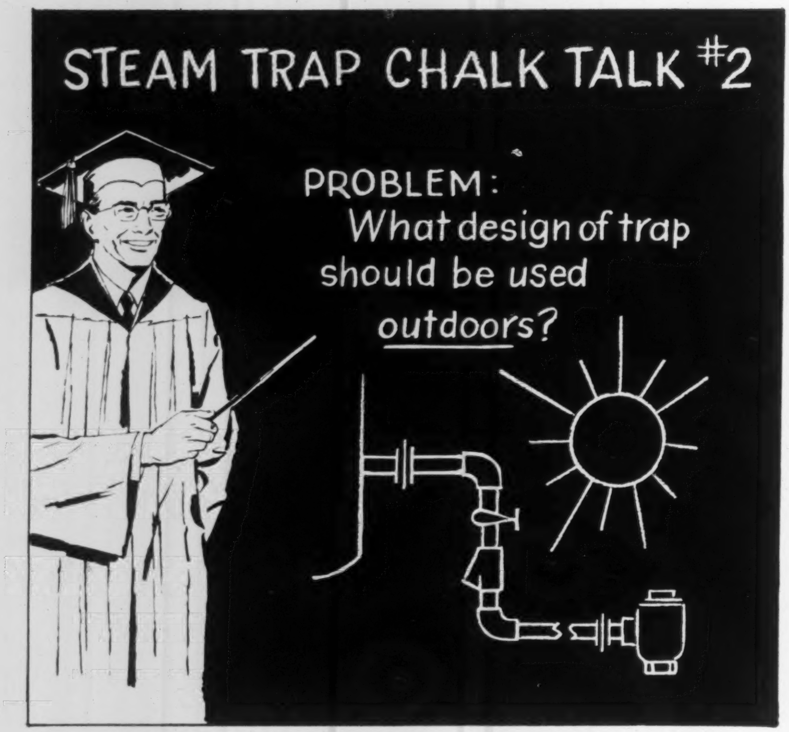
WRITE FOR KEFLEX BULLETINS
A KEFLEX REPRESENTATIVE IS NEAR YOU

U. S. Flexible Metallic Tubing Co.

Since 1905

KEFLEX MANUFACTURING DIVISION

General Offices—63 Main St., San Francisco 5, Calif.
Factory—Los Angeles
Sales Offices—Agents in Principal Cities of United States and Canada


STEAM TRAP CHALK TALK #2
PROBLEM:
What design of trap should be used outdoors?

● First, use Anderson Quik-Flex thermostatically designed steam traps. These traps have no pockets in which water will collect and freeze. An open pipe on the discharge side provides constant drainage and eliminates any maintenance during freezing temperatures.

Second, use a cooling leg of at least three feet. Thermostatic traps operate on temperature differential, and sufficient piping must be provided for the condensate to cool.

Third, install the strainer in a down position. Strainers in horizontal positions collect condensate which freezes and breaks the strainer body during cold weather.

Anderson Quik-Flex Steam Traps are built especially for outdoor service. Guaranteed freeze-proof for two years, they provide a lifetime of trouble-free, freeze-proof draining of condensate from steam lines. Mail coupon for complete details.

A TRAP FOR EVERY PURPOSE

ANDERSON TRAP NO. B-1
OUT

THE V. D. ANDERSON COMPANY
division of International Basic Economy Corporation
1949 West 96th Street • Cleveland 2, Ohio

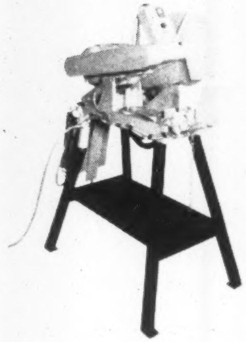
Please send without obligation your catalog describing Anderson freeze-proof Quik-Flex Thermostatic Steam Traps.

Name__________ Title__________
Company__________
Address__________
City__________ Zone_____ State__________

ANDERSON QUIK-FLEX

EQUIPMENT DEVELOPMENTS
Continued

perature controller monitors, controls temperatures within range of 100 to 400 F, using no electronic tubes. Accuracy for temperature control is ±3 F of the level selected; accuracy for indication by meter reading in ±6 F. Power output of device is 5 watts at 24 volts d-c; power input is 115 volts at 60 cycles. Temperatures are sensed through standard copper temperature detectors.



Pipe Cutting Machines . . .

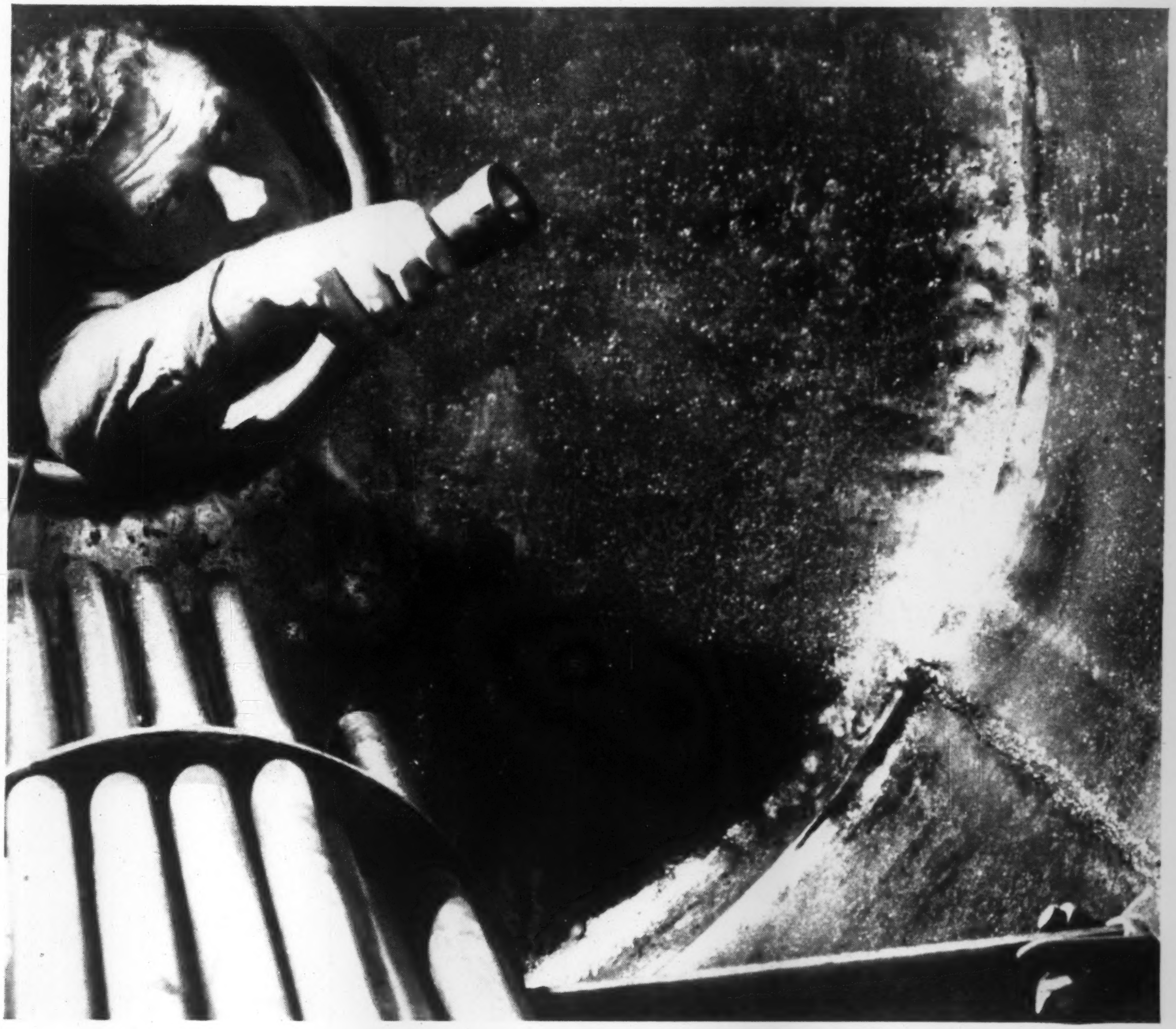
. . .available with power head—*Beaver Pipe Tools, Inc., Dept. HPAC, 310 Dana Ave., Warren, Ohio.*

"Speed Cut" abrasive cutting machine cuts up to 4 in. pipe and 1½ in. rod. Nonferrous material cut with 14 in. steel saw using automatic mist oil spray. Ferrous materials cut with 14 in. abrasive wheel. Equipped with 5 hp, 3 phase, 60 cycle motor.

Sealed Thermostat . . .

. . .designed with sealed construction primarily for air conditioning applications—*Metals & Controls Corp., Versailles Products Div., Dept. HPAC, Versailles, Ky.*

"Klixon 20420 Series" thermostats suitable for applications in operating range of −20 to 167 F where sealed construction is desirable. All operating parts, lead connections contained in copper cup sealed with epoxy resin to keep out moisture, dust, contamination. Thermostat can be used as fan switch, high limit



Still no sign of wear or corrosion in Patterson-Kelley storage water heater

AFTER 26 YEARS OPERATION

Credit Revere Copper for this outstanding performance

The copper-lined heater you see above was installed in the Bronx County Courthouse Building, New York City, in 1932, and processes rust-free hot water for the 1,000 staff members and more than 5,000 visitors daily.

Department engineers inspected the heater annually, the last inspection being in June, 1958. At that time the above photo was taken of the heater's interior. After 26 years constant use, processing over 8,500,000 gals. of water at the average rate of 4 tons per day, the heater was found to be in excellent condition, all original fittings in good operating condition and copper tube bundles and supports showed not one sign of wear or corrosion. Once again copper has proved a most efficient, economical and durable material in storage water heater service.

Find out how copper and its alloys can help you in your corrosion problems, whether it be storage water heaters, heat exchangers, condensers or distillation units. Call on Revere's Technical Advisory Service with its great storehouse of knowledge on this subject.

REVERE COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801
Executive Offices:
230 Park Avenue, New York 17, N. Y.

Mills: Rome, N. Y.; Baltimore, Md., Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Brooklyn, N. Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere.

NEW dry-acid cleaners are concentrated, easier to handle, require less storage space. One 100-lb. drum, for example, occupies only 1.9 cubic ft. of storage space — is more than equivalent to a 192-lb. carboy of 18° Be' HCl.

OLD cleaning method required stocking bulky, returnable carboys of liquid acids. Special precautions are necessary in shipping and handling. And a 192-lb. carboy of 18° Be'hydrochloric acid occupies 5.6 cubic ft. of valuable storage space.

✓ **Lower storage cost**

Just one of the reasons why **Dry Acid Cleaners** based on **Du Pont Sulfamic Acid** are gaining wide favor for industrial equipment cleaning: ✓ Safer to handle ✓ Easy to use ✓ No hazardous fumes ✓ Powerful descaling action ✓ Less corrosive ✓ Lower handling and shipping costs.

CLEANERS BASED ON SULFAMIC ACID REMOVE SCALE AND DEPOSITS FROM:
Air-Conditioning Cooling Towers, Ice-Making Machines, Evaporating Condensers.

DU PONT REG. U.S. PAT. OFF. **Sulfamic Acid**

BETTER THINGS FOR BETTER LIVING... THROUGH CHEMISTRY

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☐ Free booklet about dry-acid cleaners based on Du Pont Sulfamic Acid

☐ Names of formulators who offer these cleaning compounds

E. I. du Pont de Nemours & Co. (Inc.)
Grasselli Chemicals Dept., Rm. N-2543HP
Wilmington 98, Delaware

Name____________________

Firm____________________ Title__________

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City____________________ State__________

control; switching action is either single-pole, single-throw or single-pole, double-throw.

Compression Fitting . . .

. . . developed for joining pipe up to 2 in. diam—*Dresser Mfg. Div., Dresser Industries, Inc., Dept. HPAC, 49 Fisher Ave., Bradford, Pa.*

Compression fittings available in over 6000 types and sizes with threaded end-nuts that screw onto threaded body to compress resilient gaskets and make tight seal, according to company. Only pipe joining tool required is wrench. Fitting flexibility permits 1/16 in. pipe movement as well as pipe deflections up to 6 deg. Fitting bodies of high strength steel or certified malleable iron, conforming to ASA specifications for 150 psi malleable fittings.

Tubing Insulation . . .

. . . formulated to stop condensation on cold lines, provide thermal insulation for copper tubing carrying hot, cold, or chilled water, or other liquids, gases—*Insul-Coustic Corp., Dept. HPAC, 42-23 54th Rd., Maspeth 78, N. Y.*

"Clocel" closed cellular nitrogen-filled tubing insulation has K factor of 0.28 at 75 F. Effective temperature

THE CHASE MANHATTAN BANK

World's Largest Completely Air Conditioned Building

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Architects

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Turner Construction Co.
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. . . as in most modern buildings— commercial, industrial, institutional—

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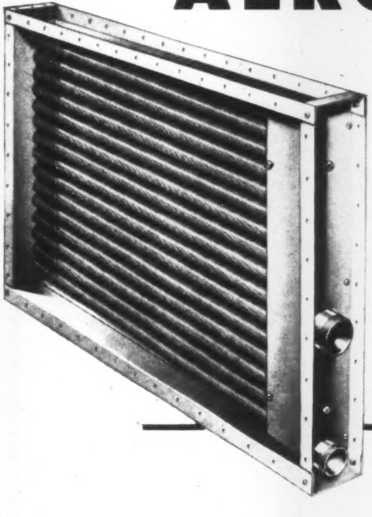

Modern smooth-fin design of Aerofin coils permits ample heat-exchange capacity in limited space—permits the use of high air velocities without turbulence or excessive resistance.

Aerofin performance data are laboratory and field proved. You can safely specify Aerofin coils at full published ratings.

AEROFIN CORPORATION

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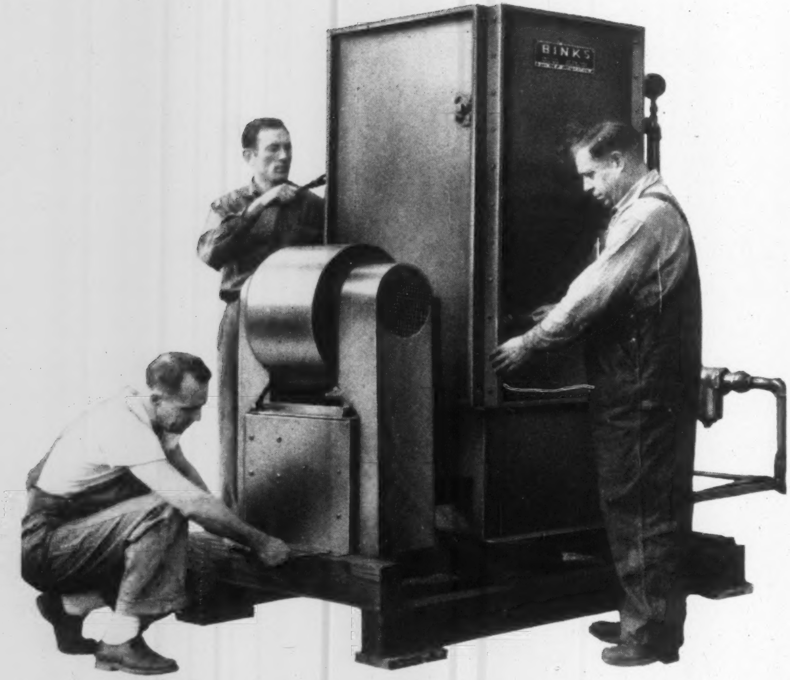
Aerofin is sold only by manufacturers of fan system apparatus. List on request.

ENGINEERING OFFICES IN PRINCIPAL CITIES



These 3 men set up this tower in 2 hours

A Binks 3B4 cooling tower goes up in just 6 man-hours. Troublesome fabrication and fitting details are eliminated for you at the factory so you can figure job-site erection costs almost to the penny.

Once your tower foundation is in place, erection goes like clockwork. The blower, supporting frame, V-belt drive and motor and water basin are shipped sub-assembled. Tower casing, decking, drift eliminator, water distributing headers and gasketing materials arrive knocked down.

Quality you can recommend

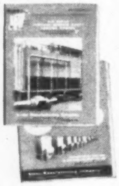
Binks 3-B cooling towers are designed and built to give exceptionally quiet, trouble-free service year after year. Call-backs are few and maintenance is low.

A tower for every requirement

Whether you need a single tower with a 6-ton capacity or a multiple tower package up to 330 tons, you will find exactly what you need in the Binks 3-B series.

Send for free bulletins

See for yourself the many advantages which Binks cooling towers have to offer . . . in selection, in erection economy, in trouble-free service. Ask your Binks Branch Office for a copy of Bulletin 477-A and 333. Or, write direct. No obligation.



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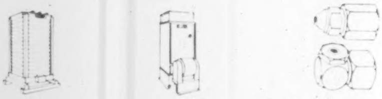

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A COMPLETE LINE OF NATURAL DRAFT AND MECHANICAL DRAFT COOLING TOWERS AND INDUSTRIAL SPRAY NOZZLES

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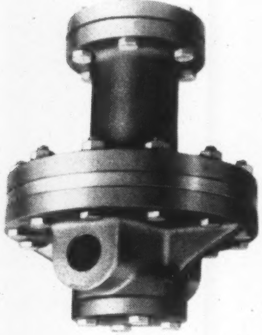
range is from zero to 200 F. Produced in standard copper tubing sizes from $^3/_8$ to $3^1/_8$ in. ID. Available wall thicknesses are 3/16, $^1/_4$, $^3/_8$, $^1/_2$, $^3/_4$ in.

Magnetic Contactors . . .

. . .developed for air conditioning applications—*Furnas Electric Co., Dept. HPAC*, 1000 *McKee St., Batavia, Ill.*

"Class 41" magnetic contactors rated in 20, 30, 40 amp sizes, 2, 3, 4 pole. Descriptive bulletins "41-B1" and "41-B2" present line, giving descriptive data, full load and locked rotor amp ratings, coil characteristics, additional engineering data.



Pressure Regulators . . .

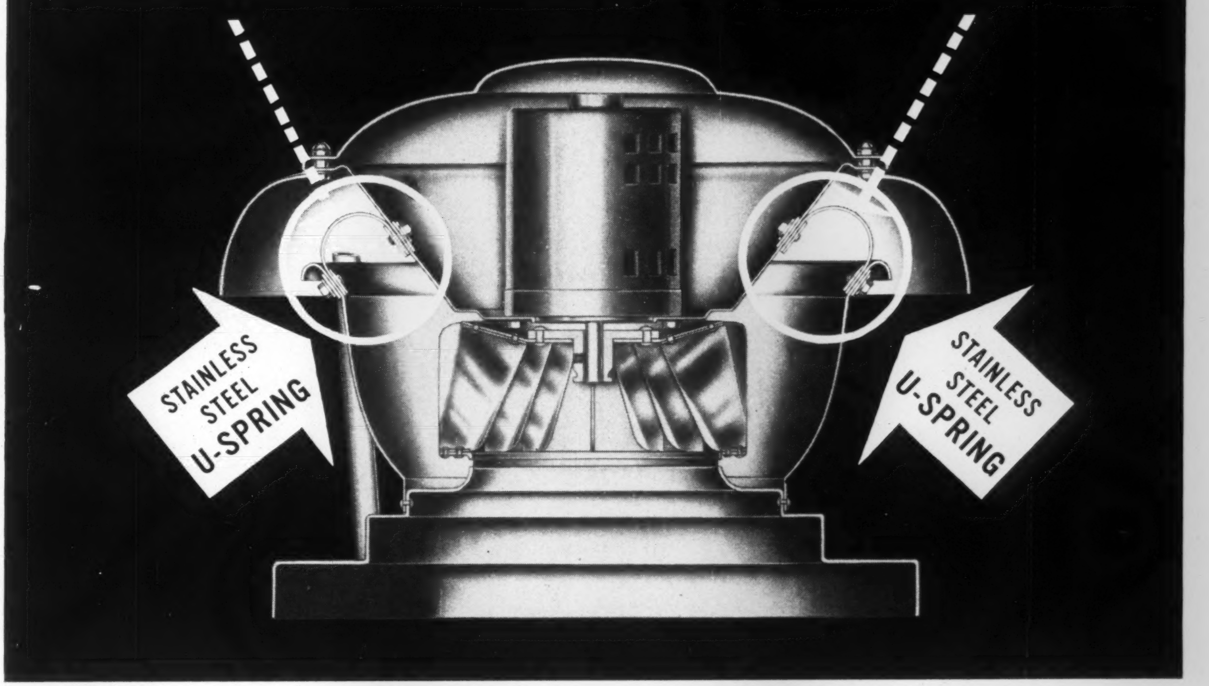
. . .developed for steam service—*Atlas Valve Co., Dept. HPAC*, 280 *South St., Newark* 5, *N. J.*

"Fig. 1200, Type C" differential pressure regulator controls atomizing steam pressure at an adjusted value higher than fuel oil pressure. "Fig. 1210, Type C" controls steam pressure at an adjusted value lower than fuel oil pressure. Both valves available in sizes $^1/_2$ to 2 in. O-rings suitable for 400 F. Range of differential pressure adjustment is 5 to 45 psi.

O-Ring Seal Fitting . . .

. . .designed with standard tapered pipe threads, permitting connection to existing female pipe threads, securing positive seal without use of sealants—*Crawford Fitting Co., Dept.*

GUARANTEED FOR LIFE!



Stainless steel U-spring noise and vibration isolators . . . a Jenn-Air exclusive!

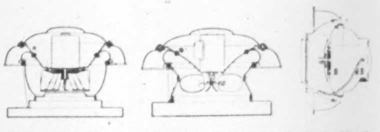
Most power exhausters depend on rubber isolators to dampen noise and vibration. Rubber does a reasonably good job when new, but it cannot withstand the ravages of heat, moisture and oil. Eventually, like the tires on your car, rubber isolators break down, leaving you with expensive repair bills or the need for complete exhauster replacement.

Dissatisfied with the impermanent nature of rubber, Jenn-Air engineers set out to develop a vibration isolator that would not break down. What they perfected was a unique power assembly suspension system built around stainless steel U-springs. Three to five U-springs are now used in each direct driven Jenn-Air Exhauster. They eliminate noise by isolating both radial and lateral vibration . . . and they're *guaranteed for life.*

In addition to providing lifetime service, Jenn-Air U-springs absorb 44% more vibration than rubber isolators. This fact was proved conclusively in independent tests conducted by the Pittsburgh Testing Laboratory.

Effective elimination of vibration is the key to quiet operation and long exhauster life, and Jenn-Air does this job better than any exhauster made! Jenn-Air's complete line of spun aluminum exhausters for roof and wall installation is covered in Bulletin 58-B . . . write for your copy today.

First Name in Power Exhausters



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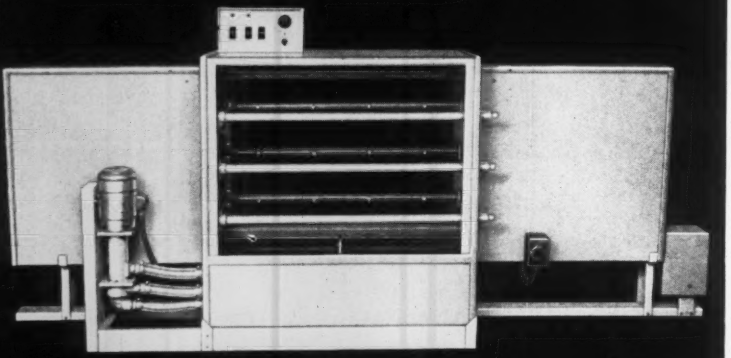
Unique Fabrication Shows Versatility
of
VAN-COR PVC



Production Etcher for Printed Circuits, made by Centre Circuits, Inc., State College, Pa.

To resist acid corrosion, this etcher is primarily made of Van-Cor PVC pipe, fittings, (standard and specially machined), valves, sheet (transparent and regular), and joining strips.

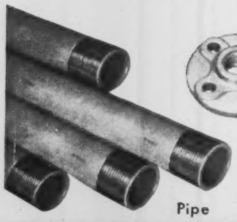
HOW CAN VAN-COR SERVE YOU?

Van-Cor PVC has many applications for plant use, or in your end product. It is ideal for plating equipment, filters, flux spray booths, chemical treatments, bleaching operations, glass polishing, and corrosive fume handling in general.

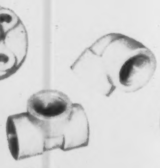
ADVANTAGES OF VAN-COR

1. Resists Corrosion of Industrial Acids & Alkalies
2. Light in Weight (½ that of Aluminum)
3. Easily Installed; High Tensile Strength; Low Flow Resistance
4. Readily Formed, Machined, Threaded and Welded

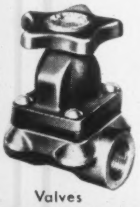
Write for Catalog and Name of Nearest Distributor



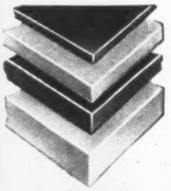
Pipe



Fittings



Valves



Sheets

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COLONIAL PLASTICS MFG. CO.
Subsidiary of THE VAN DORN IRON WORKS CO.
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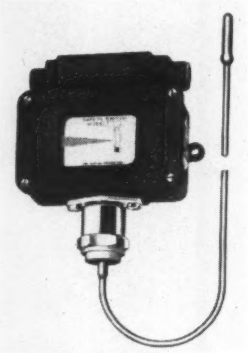
HPAC, 884 E. 140th St., Cleveland 10.

O-ring seal in "Swagelok Fitting" built integrally into body of fitting. Tight sealing action said to permit use of fitting for pressure connections or high vacuum applications with leakproof requirements. Male connectors and adaptors available in all machinable metals, plastics in sizes for 1/16 through 1 in. OD tubing.



Safety Switch . . .

. . .designed as safeguard for pilot flame applications—*Partlow Corp., Dept. HPAC, 517 Campion Rd., New Hartford, N. Y.*

In event of pilot flame failure. "SBS" safety switch automatically shuts down both pilot and main fuel flow by actuating solenoid valve within 30 to 45 sec. Proper operating temperature for bulb on switch is between 1200 and 1400 F.

Equipment Briefs . . .

MOTOR developed for use in air moving and small machine applications—*General Electric Co., Dept. HPAC, Schenectady, N. Y.* "Uni-

MEMO TO
MANAGEMENT MEN
IN THE MAKING:
Thurston

WHERE THERE'S BUSINESS ACTION THERE'S A BUSINESSPAPER

Some blessings we take for granted. Like ice cubes. Or indoor plumbing. However, older men—wiser men—say a little prayer of thanks for things they know they couldn't do without.

Among these wiser men are the men who make top-level decisions in business.

To make decisions, they must have facts. All the facts. All the pertinent information they can get. And they get a major portion of that information from one unique source: the business publications they subscribe to.

No businessman is fully informed until he reads his businesspaper. He reads it for profit, not for pleasure. He searches it through for news of the trade or industry. For facts. For fresh ideas. For new products he can put to work. And he reads the advertising with the same intense concentration he devotes to the editorial pages.

He knows that his businesspaper is vital to his success—to his very livelihood. And he says a little prayer of thanks.

Every man on the way up can profit from his example. Take a tip from the reading habits of key men at every level. Take out a subscription of your own. Read every issue...and read it searchingly. It's *your* businesspaper, too.

Heating, Piping & Air Conditioning

6 North Michigan Ave., Chicago, Ill.

One of a series of advertisements prepared by THE ASSOCIATED BUSINESS PUBLICATIONS

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- One Unit for Space Heating, Ventilating, Make-Up Air, Oven Applications and Drying
- Gas, Oil or Combination Burners
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Never before has one heater handled so many jobs so well, at such a sensible cost.

Completely proven and tested, the "OG" series can be used as a central system . . . with ducts . . . or as a unit heater. Installation may be horizontal, vertical, suspended or floor mounted. Dynamically balanced blower delivers a huge volume of air . . . with super-quiet action. But this just begins the "OG" story . . . write for full specs . . . see for yourself how Lennox has made the basic change in industrial heating.

LENNOX "Task Matched" Equipment to control and condition air for industry

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INDUSTRIAL DIVISION
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Company
Address City
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EQUIPMENT DEVELOPMENTS

Continued

tized" motor available in 4 pole KSM-59-frame shaded pole. Permanent split capacitor ratings up through 1/15 hp. Motors in 2-pole shaded-pole ratings through 20-milli-hp and universal series motors of various ratings soon available.

INFRA-RED HEATER with element operating in radiant wave length of 1.7 to 3 microns with peak of 2.2 microns—*N. J. Thermex Co., Inc., Dept. HPAC, 533 Bergen St., Harrison, N. J.* Element of "Add-A-Unit" heater mounted in reflector housing designed to be placed side by side, end to end, or around bends on simple angle iron frames. Special units with hollow centers are also available from manufacturer.

PUMP IMPELLERS developed for use with self-priming pumps—*Special Products Div., Pacific Moulded Products Co., Dept. HPAC, 905 E. 59th St., Los Angeles* 1. Features cited by manufacturer include: high tensile strength; resistance to oxidation, compression set, abrasion, tearing. Plastic construction allows handling of liquids from 40 to 175 F. Available in sizes suitable for pumping capacities from ½ to 120 gpm, operating at speeds from 300 through 6000 rpm.

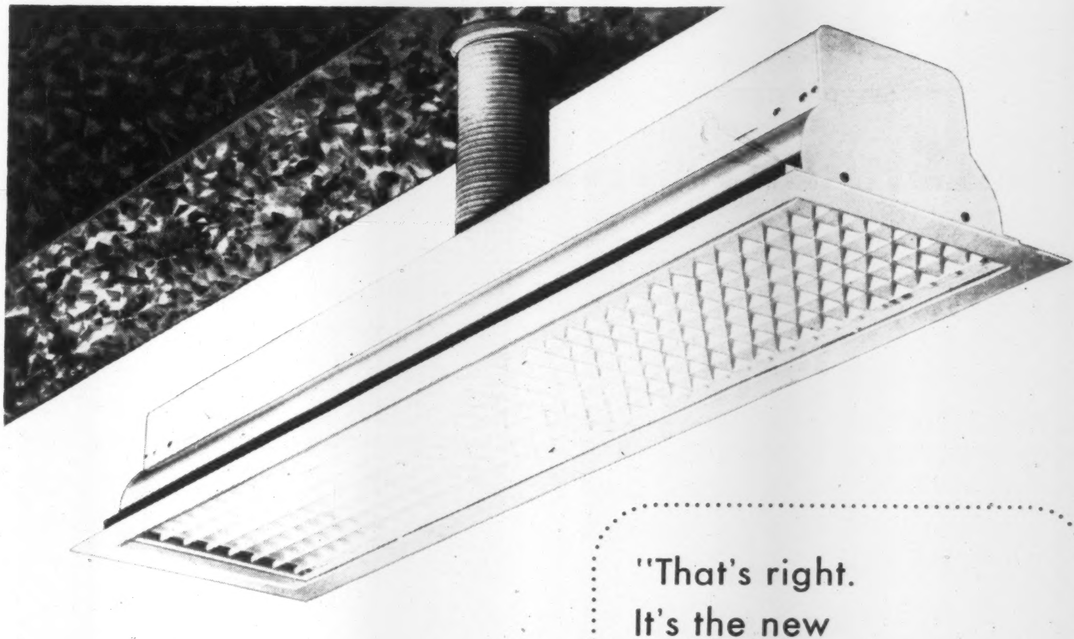
PROTECTIVE COATINGS containing non-leafing type of aluminum pigment—*United Laboratories, Inc., Dept. HPAC, 16801 Euclid Ave., Cleveland* 12. Formula "162-G" contains a synthetic oil, non-leafing aluminum, asbestos fiber, and color pigments. Oil in coating is alkali resistant. Available in red, brown, blue, green, gray, white.

WATER CONDITION DETECTOR developed to indicate tendency of boiler water to cause intercrystalline cracking—*Betz Laboratories, Inc., Dept. HPAC, Gillingham and Worth Sts., Philadelphia* 24. "Embrittlement Detector" consists of block 5 in. long, 3½ in. wide, and 2¼ in. thick with ¾ in hole bored, through which boiler water circulates to keep unit at boiler temperature. Conditions for intercrystalline cracking reproduced artificially on test specimen.

PLASTIC MASTIC manufactured from epoxy-polyamide chemical compound—*Williamson Adhesives, Inc., Dept. HPAC, 8220 Kimball Ave., Skokie, Ill.* Recommended by manufacturer for industrial repair jobs such as repairing floors, walls, ceilings, masonry, bricks, fixtures, tanks, pipes, and cracks. Repair kit supplied in quart half-gal, 2 gal sizes; each kit contains can of white base and can of black hardener. At room temperature material hardens in 4 hr; curing can be speeded by application of heat.

ANODE PLASTIC HEAD for heat treaters or oil emulsion treaters—*Tejas Plastics Materials Supply Co., Dept. HPAC, P. O. Box* 11302, *Fort Worth, Texas.* New plastic insulating head manufactured by Lone Star Plastics designed to give permanent insulation and support to anode, molded on to give leadproof connection. Designed for installation into victaulic-type nipple. Material used in head is glass and fiber reinforced resin.

SCAFFOLDS with 3 piece "unit" construction—*Davis Scaffold Co., Dept. HPAC, Lannon, Wis.* Scaffold unit consists of two end-frames and a one piece platform. Can be assembled by one man in less than a minute, according to manufacturer. All models said to exceed 100 lb per sq ft test rating. Three standard platform sizes available: 4 × 8 ft, 2 ft, 2 in. × 8 ft., 2 ft. 2 in. × 4 ft. Single unit platform heights adjustable to 6 ft. 3 in. with provision for multiple stacking. +



"You mean you get both air *and* light from the same unit?"

"That's right. It's the new **MULTI-VENT TROFFER** The air diffuser is completely concealed in the flush light fixture!"

There's more to the new **MULTI-VENT TROFFER** than meets the eye!

It combines a great advance in gently diffused, draft-free air conditioning, with modern, highly efficient lighting at a substantial savings in cost!

Complete concealment of the air diffuser within the handsome light fixture means freedom for the architect to design clean, uncluttered ceilings, greatly simplified mechanical planning for the engineer and . . . for the contractor . . . faster, easier field installation.

Write for detailed literature and the name of the representative in your area.

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WRITTEN WARRANTY

Exclusive! The ultimate in Sun-Shading protection... now assured in writing!

Not in the history of solar screening itself has there been such protection. Now—with KOOLSHADE SunScreen and KOOLFRAME Extrusions—you get a *written Warranty* of the quality materials and workmanship that gives you KOOLSHADE performance at its finest!

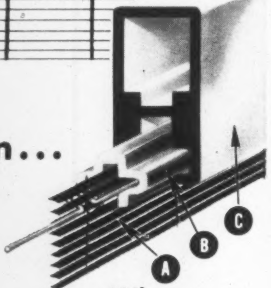
You get written assurance, for example, of defect-free KOOLSHADE Screening. Designed to intercept 89% of the sun's hot rays, precision screen construction is the "secret" of *these* KOOLSHADE advantages:

- Unequalled heat-shading efficiency
- Maximum air conditioning economy
- Dependable glare-shading protection
- Up to 83% clear outward visibility

You get written assurance, too, of top quality KOOLFRAME Extrusions. Designed specifically for KOOLSHADE, these heavy-duty aluminum frames give you *these* advantages:

- Sleek, streamlined appearance
- Long, maintenance-free service

Send today for full data on this remarkable new Warranty. See for yourself how today's KOOLSHADE protects your investment . . . as it guards your windows from glare.



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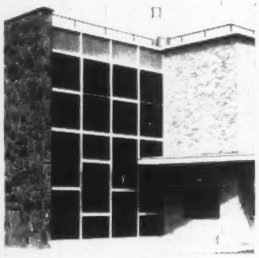
Basis for this remarkable new Warranty is the unique framing method you see above. Note how the woven KOOLSHADE Screen (A) is encased in an insulating vinyl spline (B) . . . then literally *suspended* within the specially-designed KOOLFRAME Extrusions (C). In this way, the KOOLSHADE remains under proper tension at all times . . . without bending or crimping.



KOOLSHADE® BW

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RECENT TRADE LITERATURE . . .

▶ *ALLOY VALVES*—Bulletin "No. 10" presents "Hastelloy" valves in alloys B, C and D. Casting techniques described. Uses for alloys in hydrochloric acid, sulfuric acid, chlorine, other corrosive environments discussed. Includes illustrations of valve designs; presents chemical composition and mechanical properties. *Alloy Steel Products Co., Inc., Dept. HPAC, 1322 W. Elizabeth Ave., Linden, N. J.*

▶ *ALUMINUM TUBING*—New 18 page aluminum mill products brochure gives complete specifications for alloys, other forms of aluminum available from company. Publication includes discussion of advantages of aluminum over other materials, alloy and temper designations, fatigue and shearing strengths, various alloys available in foil, sheet and plate, wire, rod and bar, tubing and pipe, extruded and structural shapes. Fabricating and finishing techniques also presented. Bibliography to related literature and movies available from company provided. *Reynolds Metals Co., Dept. HPAC, Box 2346, Richmond, Va.*

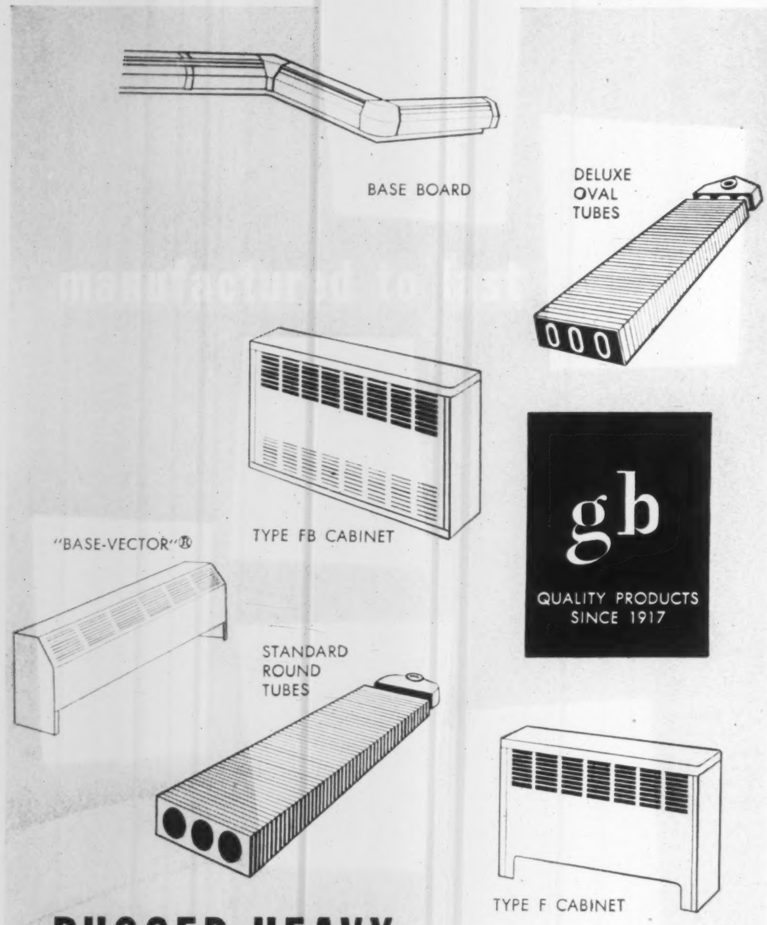
▶ *BOILER WATER TREATMENT*—New technical bulletin describes use of sodium sulfite, anhydrous technical "Santosite" for removing oxygen from boiler feed water. In addition to describing use in attacking boiler corrosion, bulletin also describes action of oxygen in boiler corrosion, the principle of product's treatment and operating procedures. *Monsanto Chemical Co., Inorganic Chemicals Div., Dept. HPAC, 800 N. Lindbergh Blvd., St. Louis 66.*

▶ *BUILDING INSULATION*—New 8 page brochure contains information about company's building insulations, including: standard glass fiber building insulation faced with kraft

Stop worrying! You know you've never felt better in your life!
Guess I ought to see the doctor about that . . .

Don't be your own worst enemy! If you notice one of cancer's danger signals in yourself, don't talk yourself into thinking it's nothing to worry about. See your doctor. Only **he** can tell. To learn the seven danger signals and to find out how to guard yourself against cancer, call our nearest office or just write to "Cancer," in care of your local post office.

AMERICAN CANCER SOCIETY



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STEEL CONSTRUCTION

means proven efficiency, durability, practical quiet operation

The big difference in fin type heating units does not lie in efficiency alone, but in the heavy steel constructed units which hold the heat longer and are economical in fuel consumption.

Convectors made of steel give performance unequalled by light thin metals; take more abuse and withstand the severest handling on the job and subject to no loss of efficiency caused by mutilated fins.

Pioneers in the field of convector radiation, GOVERNALE BROS. Inc., have been manufacturing steel convector radiators for over a quarter of a century.

Engineers and builders have come to expect the finest quality convectors from GOVERNALE.

On your next heating job consult your local distributor or write, wire or telephone GOVERNALE for literature.

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Established 1917

Exclusive territories open to Authorized Distributors. Write for detailed information.

paper; foil-faced insulation; foil-enclosed insulation; pouring wool insulation; blowing wool insulation; perimeter insulation. Also contains information and sketches illustrating areas in home which should be insulated. *Owens-Corning Fiberglas Corp., Dept. HPAC, National Bank Bldg., Toledo 1, Ohio.*

▶ *COMBUSTION INDICATOR*—"Bulletin 802" available for reference to fuel savings through increased combustion efficiency. Contains schematic diagrams of installations, various relay circuits. Describes "Hazegage" combustion indicator, outlines new operating techniques incorporated into photoelectric unit. *Ess Instrument Co., Dept. HPAC, 96 S. Washington Ave., Bergenfield, N. J.*

▶ *COMPRESSED AIR FILTERS*—Bulletin "R-35" covers uses, operation, design features of prefilters for compressed air and gas systems. Data sheet is illustrated; also has table giving dimensions for entire line. *Desomatic Products, Inc., Dept. HPAC, 1109 W. Broad St., Falls Church, Va.*

▶ *CONTROLLED VOLUME PUMPS*—New, 4 page, illustrated bulletin covers company's line of controlled volume "miniPumps" for metering chemicals in minute volumes against pressures. Pumps said to meter as little as 3 ml per hr with accuracy of ± 2 percent. Bulletin "1257-1" contains complete specifications on laboratory, industrial, chromatographic designs of pumps. *Milton Roy Co., Dept. HPAC, 1300 E. Mermaid Lane, Philadelphia 18.*

▶ *CONVERTORS*—"Catalog 200-A" gives complete information on manufacturer's line of steam convertors. Features, installation data given in text, pictures; specifications, dimensions and capacities presented in

VIBRATION & NOISE CONTROL NEWS

FROM THE APPLICATION ENGINEERING DEPARTMENT OF THE KORFUND COMPANY, INC.

Spring Isolators Permit Roof Mounting of 530 Ton Refrigeration Machine... Increase Rentable Space in D. C. Office Building

Department Store Gets Noise-Free Sales Area By Spring Mounting Penthouse Fan

In planning the Lit Bros. Department Store, Camden, N. J., Thalheimer & Weitz, Philadelphia architects and engineers, wanted to be sure that vibration and noise from penthouse fans would not disturb patrons in the sales areas below. Also, the fan's mounting system had to provide maximum protection of the building structure.

Together with the Carrier Corp., suppliers of the air conditioning equipment, they decided on Korfund steel spring mountings to handle the important job of vibration and noise control.

Working closely with the architects and the air conditioning contractor, Korfund engineers mounted the fan together with its structural steel base on special Korfund Type UP isolators, in order to provide all the static deflection needed to stop the transmission of low frequency disturbance. The isolators themselves were cemented to Elasto-Rib sound insulation pads, eliminating all anchor bolts. The result is air-conditioned — and noise-free — comfort for Lit Brother's patrons, even in the area directly below the fan.

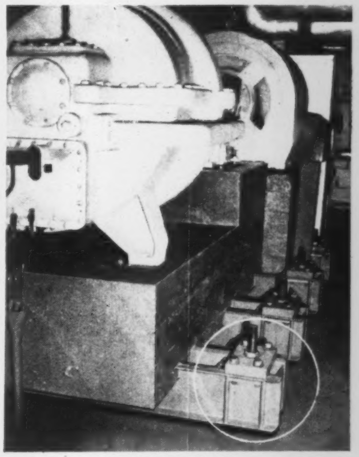
Westinghouse #155 SV-10 fan and its 200 hp, 1500 pound motor at the Lit Bros. Department store, Camden, N. J. Korfund spring mounts permitted installation of this fan and a smaller one in machinery penthouse directly over a sales area, prevented vibration transmission.

Korfund steel spring isolators were called upon to perform a critical job of vibration and noise control in the Cafritz Building, Washington, D. C.* The "drive-in" office building features basement parking, requires roof top mounting of all equipment in order to get maximum rental space in the parking area. Yet noise or vibration transmission from the equipment to the offices below could not be tolerated.

Potential source of trouble was the 530 ton centrifugal refrigeration machine, key unit in the building's air conditioning system. It was apparent that extreme isolation efficiency was needed to prevent annoying vibration from penetrating the upper stories and also to protect the building structure.

When Korfund engineers were called in they recommended soft, resilient mounting, similar to that used successfully by Korfund in hundreds of thousands of other tough installations of all types. Following their recommendation, 8 performance-guaranteed Type U V Steel Spring Vibro-Isolators were used to float the machine, completely eliminating vibration and noise transmission at a cost of only $1500.

The effective isolating characteristics engineered into Korfund vibration and noise control units give them wide application for all rooftop and other critical installations.



Circled is one of the 8 Korfund Vibro-Isolators used to "float" office building refrigeration machine.

*Architect: LeRoy L. Weiner
Consulting Engineer: William Brown
Builder: Cafritz Construction Co.
Mechanical Contractors: Mehring & Hanson Co.

Noise Free Heating-Cooling System 8 Stories Up

Photograph shows a boiler, part of the complete Korfund-mounted heating and air conditioning system, being installed on the roof of the 8-story 1500 Massachusetts Ave.* apartments, Wash., D. C.

The installation, which includes boilers, pumps, compressors and fans, has been in operation over 6 years. Vibration and noise isolation is so complete that tenants on the floor below are unaware of the existence of the equipment immediately over their suites. Cost? Only about $5,000 on a mechanical equipment contract of approximately $1,000,000!

The efficiency of Korfund units for isolating noise and vibration did not come about by accident. It's the result of more than half-century of experience in vibration and noise control. To learn how this experience can work for you just drop a line to Korfund or call the Korfund representative in your area.

*Architect: F. Wallace Dixon
Consulting Engineers: Karsunky, Weller & Gooch
Builder: Ring Engineering Co.

FOR MORE DATA OR SPECIFIC RECOMMENDATIONS WRITE TO KORFUND FOR BULLETIN #66

THE KORFUND COMPANY INC.
48-01F 32nd Place • Long Island City 1, New York

VIBRATION • SHOCK • NOISE/CONTROL AND MEASUREMENT
Specialists for over half a century

HYDROTHERM

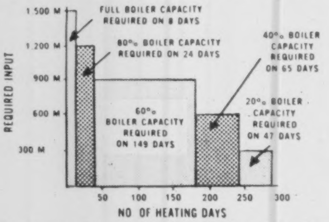
PACKS A 20% GAS SAVING HERE
Here's where MultiTemp reduces gas costs by 20%. Return header has independent, differentially set aquastats that trigger each boiler, modulate input, and eliminate short cycling waste.

New MULTITEMP SYSTEMS

Make Gas Heat Competitive on "BIG JOBS"

Now even the big jobs requiring up to 3,600,000 BTU/hr input can enjoy the convenience and cleanliness of gas heat. A Hydrotherm MultiTemp system achieves true input modulation, brings gas consumption down and, being composed of multiple units, insures against service interruptions.

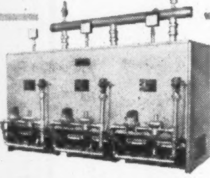
A MultiTemp battery of Hydrotherm boilers is hooked up with a separate aquastat for each boiler in the common return header. With each aquastat set for a different temperature, the boilers are fired or cut off independently. When the demand is small, only one boiler operates... when it is great or when the system is making a cold start, the complete heating plant is fired.



This graph shows the year-round load for a 1,500,000 BTU/hr hydronic plant in Bergen County, N. J., where degree days average 5600 to 6000. Heat was required for 293 days, but full capacity was needed for only 3% of that time.

Note how a single 1,500,000 BTU/hr boiler would have short cycled for 89% of the heating season at a great loss in efficiency. Note also how the MultiTemp battery of five 300,000 BTU/hr boilers modulated its input to meet the heating demand of the moment.

- ***Input Ratings from 360,000 to 3,600,000 BTU/hr***
- ***100 lbs. ASME Working Pressure***
- ***Boilers Shipped Pre-Wired and Assembled***
- ***Units Pass Thru 2'6" Doors***
- ***Ideal for Volume Hot Water***



Write today for MultiTemp Catalog

HYDROTHERM INC

DEPT. 13-AC NORTHVALE, NEW JERSEY

OTHER FAMOUS HYDROTHERM PRODUCTS: **HydroTherm • HydroVector • HydroChiller • HydroFin**

RECENT TRADE LITERATURE

Continued

tables. *Ellicott Fabricators, Inc., Dept. HPAC, Clare and Kolman Sts., Baltimore 30.*

▶ *DIRECT FIRED AIR HEATERS*—Single page bulletin "EN 5900" contains sample specifications for heavy duty, direct fired, forced air heaters. Illustrated bulletin contains quick reference data on complete line of heaters ranging in capacities from 400,000 to 2 million Btu per hr output. *Reznor Mfg. Co., Dept. HPAC, 51 Union St., Mercer 8, Pa.*

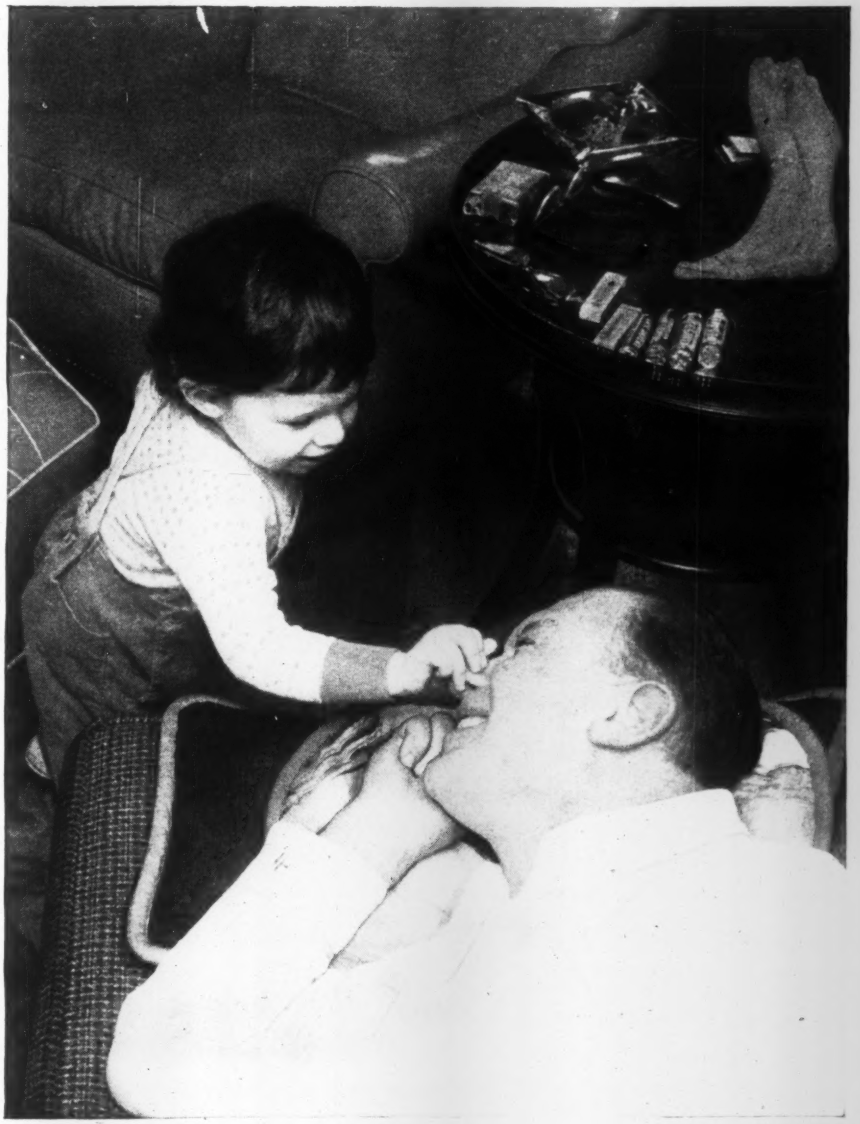
▶ *ELECTRIC HAMMER DRILL*—Illustrated leaflet describes company's new self-contained electromagnetic electric hammers and self-rotating electric hammer drills. Leaflet gives complete descriptions, data, specifications for hammers, hammer drills designed for fast cutting, chipping, drilling of concrete, masonry. Illustrations picture applications. *Syntron Co., Dept. HPAC, 161 Lexington Ave., Homer City, Pa.*

▶ *EXPANSION JOINTS*—Construction, sizes, uses of rubber, neoprene and plastic lined expansion joints explained in bulletin "AD-137." Publication describes characteristics, limitations of seven styles of expansion joints, flexible couplings. *Garlock Packing Co., Dept. HPAC, 433 Main St., Palmyra, N. Y.*

▶ *FLEXIBLE COUPLING*—Specification sheet covers company's new "Series 400" pin rubber cushioned bushing, giving specifications and ratings. Four sizes accommodate 1¼, 1¾, 2¼ and 2¾ in. maximum bores. *Ajax Flexible Coupling Co., Inc., Dept. HPAC, Westfield, N.Y.*

▶ *FLOW RATE TRANSMITTER*—New 12 page bulletin "No. 170" describes design features of manufacturer's motion position transmitter. Brochure is illustrated throughout with photos, diagrams, drawings. Unit capacities given in tabular form. *Brooks Rotameter Co., Dept. HPAC, P. O. Box 432, Lansdale, Pa.*

HELP US KEEP THE THINGS WORTH KEEPING



Nobody has to tell you why you want peace. You see it in your child's eyes and hear it in her laughter.

But just wanting peace won't *keep* it. You need to back your wanting with money. Peace costs money.

Money for strength to keep the peace. Money for science and education to help make peace lasting. And money saved by individuals to help keep our economy strong.

Your Savings Bonds, as a direct investment in your country, make you a Partner in strengthening America's Peace Power.

The chart below shows how the bonds you buy will earn money for you. But the most important thing they earn is peace.

Think it over. Are you buying as many as you might?

HOW YOU CAN REACH YOUR SAVINGS GOAL WITH SERIES E SAVINGS BONDS
(in just 8 years, 11 months)

If you want about	$2,500	$5,000	$10,000
each week save	$4.75	$9.50	$18.75

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200
100
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SERIES E

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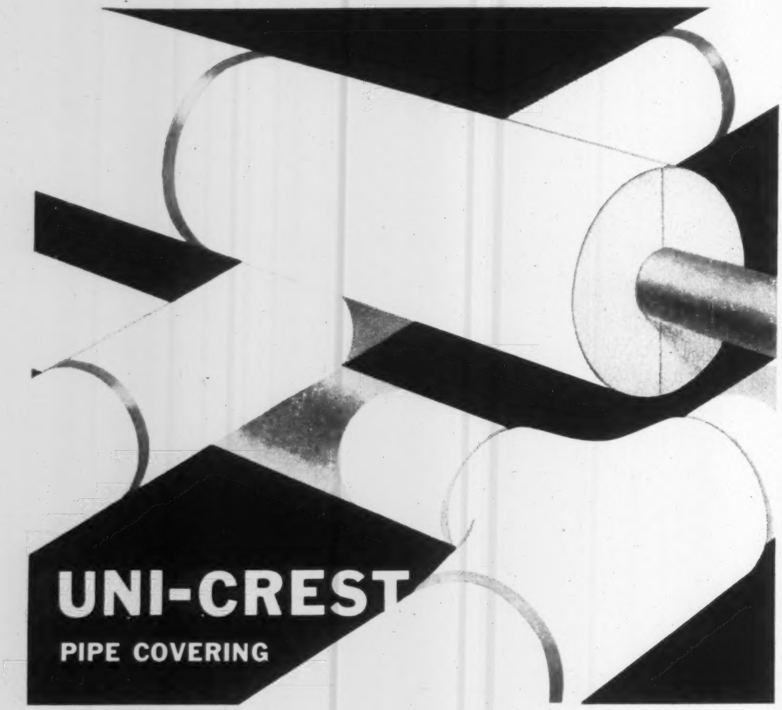

a new, economical, low temperature insulation

Uni-Crest, pipe covering, is an excellent low temperature insulating material, and is inexpensive to install and maintain.

Uni-Crest's low thermal conductivity (K factor), plus its high resistance to water and water vapor—are some of its prime qualities. It will not rot, mildew, or support fungus growth.

Extremely lightweight, with a smooth, tough white surface, Uni-Crest is non-dusting, non-flaking, and easily cut and handled on the job. And Uni-Crest is inexpensive, too.

For the address of the office nearest you, plus additional information about Uni-Crest pipe covering and an actual sample, please write to the address below.

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Since 1907

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UNI-CREST
EXPANDED POLYSTYRENE

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RECENT TRADE LITERATURE

Continued

▶ *GASKETS*—Bulletin "AD-104" details design, construction, utility, outlines particular features of metal gaskets. Publication lists various types available for special applications. "Guardian" gaskets consist of spirally wound strips of V-shaped pre-formed stainless or zinc coated carbon steel alternated with layers of asbestos or plastic. *Garlock Packing Co., Dept. HPAC, 434 Main St., Palmyra, N. Y.*

▶ *HOT WATER CONVERTORS*—Bulletin "No. SC-159" describes company's "Type SU" convertors for heating radiation water with steam. Bulletin contains rating charts for most commonly required temperature rises through wide range of steam pressures. Ratings given for heating radiation, radiant panels, snow melting. *Bell & Gossett Co., Dept. HPAC, 8200 N. Austin Ave., Morton Grove, Ill.*

▶ *INDUSTRIAL NOZZLES*—New catalog covers manufacturer's complete line of industrial spray nozzles. Publication contains 32 pages of listings, data on all types of nozzles for industrial spraying applications. Catalog is illustrated. *Wm. Steinen Mfg. Co., Industrial Nozzle Div., Dept. HPAC, 43 Bruen St., Newark 5, N. J.*

▶ *INSTRUMENTS AND VALVES*—"Index of Literature" lists literature from company's industrial and valve division. Complete alphabetical subject-company index of instrumentation magazine articles also included in 24 page bulletin. *Minneapolis-Honeywell Regulator Co., Industrial Div., Dept. HPAC, Wayne and Windrim Aves., Philadelphia 44.*

▶ *MOTOR CONTROLS*—Illustrated, condensed catalog "No. 14" intended to provide reference for manufacturer's complete line of motor controls and accessories. Illustrated with product pictures, wiring diagrams, dimensional drawings, catalog also gives complete size, weight and rat-

large or small...always specify BARRY for your air moving requirements!

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Ready for shipment (below) are several BARRY 60″ impeller diameter centrifugal fans—each capable of moving over 100,000 cfm.

A BARRY centrifugal fan with a 6″ impeller diameter takes little space, moves up to 500 cfm of air quietly and efficiently.

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Whether your specifications call for centrifugal fans with an impeller diameter as large as 90″, or as small as 6″ . . . there's a BARRY blower that can meet your needs *exactly!* Regardless of size or capacity, every BARRY unit is precision engineered, expertly balanced, and carefully tested and inspected before shipment. Fans are available in all classes from I through IV – and you'll get fast delivery on every order! When you need centrifugal fan equipment with proven efficiency and dependability – *always* specify BARRY!

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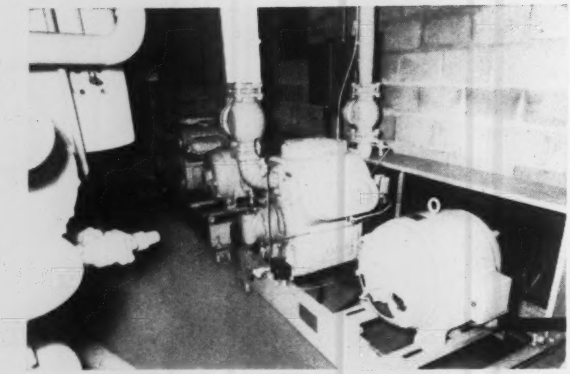


View of Vilter compressors that provide the refrigeration for the air conditioning system.

doctors
MOTEL
800 "B" Gulf Beach
Cocktail Lounge
RESTAURANT
POOL

Beautiful Doctors Motel St. Petersburg, Florida.

Comfortably Cool in a Warm Sunny Clime

Comfortably cool year 'round . . . inside, that is, at Doctors Motel, St. Petersburg, Florida. Dependable Vilter air conditioning is the answer.

There are 100 motel units at Doctors Motel and all are Vilter air conditioned. The system has a total capacity of 100 tons and is designed to keep the rooms at 78° F. and 50% relative humidity when outside temperature is 100° F. and humidity 90%.

This motel was opened to the public in December, 1956. From that time to the present *not a single adjustment has been required on the air conditioning system.* It is functioning perfectly and hasn't required any service work . . . a cost-saving installation. The owners are delighted with the performance of the Vilter system.

Vilter equipment installed at Doctors Motel includes two six-cylinder VMC Refrigerant-12 compressors; one shell and tube condenser, liquid receiver, water chiller and 100-ton heat exchanger.

Correct system layout, well-engineered equipment, careful fabrication, and floor testing of Vilter equipment pays off in efficient operation, long life and minimum maintenance. Why not call in Vilter for your refrigeration and air conditioning requirements.

Sold by Vilter Distributor, O'Dower Engineering Company, Kansas City 6, Mo.
Architects: Kivett, Myers & McCallum, Kansas City, Mo.
Mechanical Engineer: W. L. Cassell, Kansas City, Mo.

Write for this helpful bulletin to:
The Vilter Manufacturing Company, Dept. F-816
2217 S. First Street
Milwaukee 7, Wisconsin

Bulletin 820
Vilter VMC
Compressors

Vilter®

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin
Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

RECENT TRADE LITERATURE

Continued

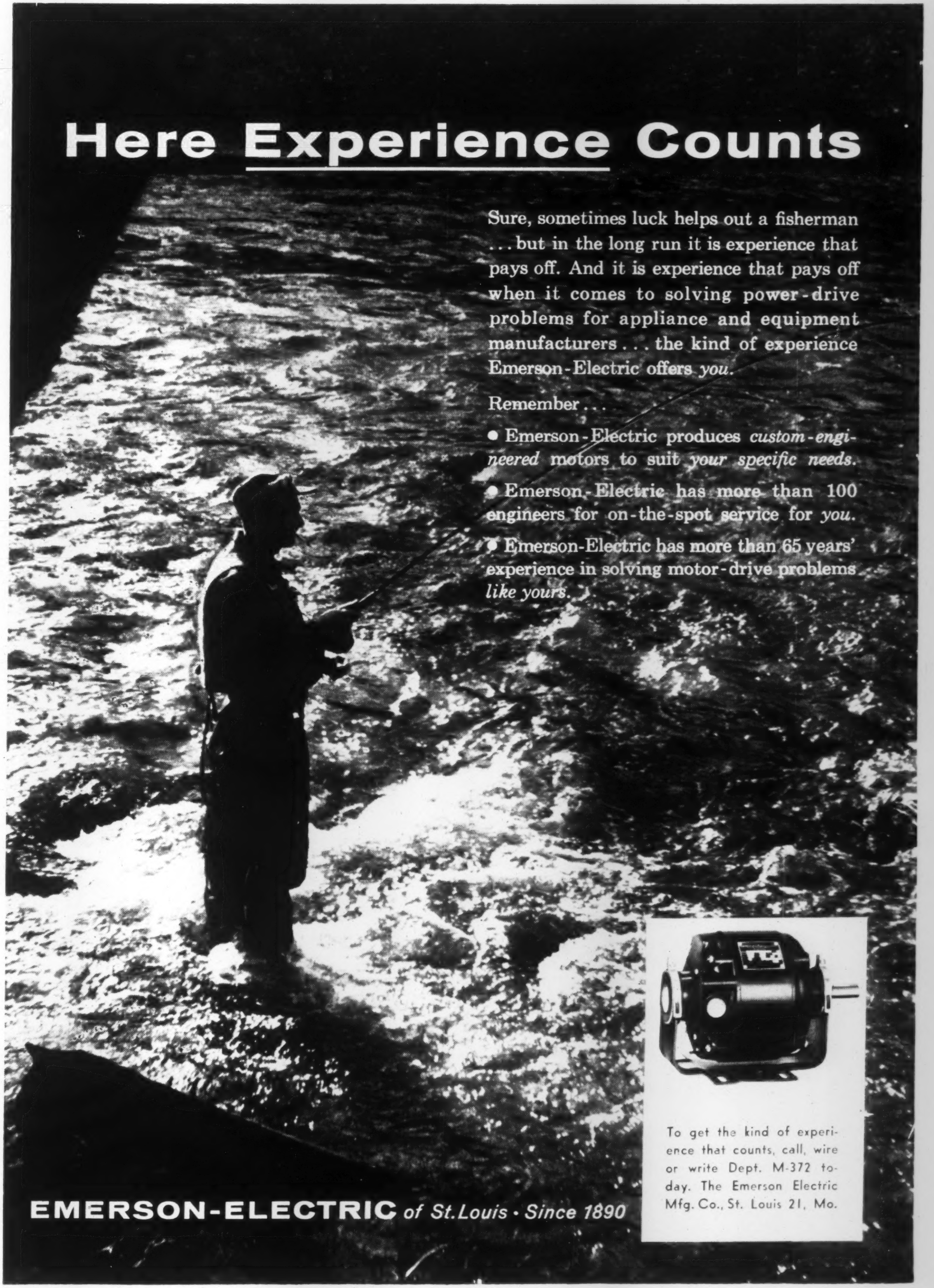
ings information. *Arrow-Hart & Hegeman Electric Co., Dept. HPAC, 103 Hawthorn St., Hartford 6, Conn.*

▶ *NON-RETURN VALVE*—Single acting, non-return valve described in new 8 page bulletin "S-2-B." Valve opens automatically when boiler pressure equals header pressure; closes automatically when pressure decreases. Bulletin contains detailed drawings of elbow, globe and angle body styles and three yoke styles; also lists complete dimension tables, gives sample specification. *Golden-Anderson Valve Specialty Co., Dept. HPAC, 1210 Ridge Ave., Pittsburgh 33.*

▶ *NUCLEAR REACTOR PUMPS*—New illustrated bulletin, "Pumps for Nuclear Reactor Systems," describes work done on critical limited-leakage pumps developed for atomic-fueled submarines, with suction conditions of 1200 psi at 550 F. Other developments include pumps for atomic powered steam generating plants, pumps for research reactors, pumps for test facilities, other nuclear pumping applications. *Peerless Pump Div., Food Machinery and Chemical Corp., Dept. HPAC, 230 W. Avenue 25, Los Angeles 31.*

▶ *ORSAT GAS ANALYZERS*—New 12 page illustrated brochure describes Orsat method of measuring gases. Complete information and specifications on all models in company's line of Orsat gas analyzers included. *Hays Corp., Dept. HPAC, 800 E. Eighth St., Michigan City 14, Ind.*

▶ *PACKAGED BOILERS*—New 16 page bulletin shows recent industrial installations of company's "Drum Modulatic Water Tube Boiler." Story of each installation given in series of photographs showing how heating problems were solved by single and multiple boilers, high and low pressure systems. *Vapor Heating Corp., Dept. HPAC, 80 E. Jackson Blvd., Chicago 4.*



Here Experience Counts

Sure, sometimes luck helps out a fisherman . . . but in the long run it is experience that pays off. And it is experience that pays off when it comes to solving power-drive problems for appliance and equipment manufacturers . . . the kind of experience Emerson-Electric offers *you.*

Remember . . .

- Emerson-Electric produces *custom-engineered* motors to suit *your specific needs.*
- Emerson-Electric has more than 100 engineers for on-the-spot service for *you.*
- Emerson-Electric has more than 65 years' experience in solving motor-drive problems *like yours.*

To get the kind of experience that counts, call, wire or write Dept. M-372 today. The Emerson Electric Mfg. Co., St. Louis 21, Mo.

EMERSON-ELECTRIC *of St.Louis · Since 1890*

"Hidden" values in

AURORA®

CENTRI-PAC PUMPS

provide long term top performance

TYPE BP
CLOSE
COUPLED

CAPACITIES TO 450 GPM • HEADS TO 140 FT.

22 Packaged Sizes

AIR CONDITIONING EQUIPMENT • CIRCULATING SERVICES
GENERAL SERVICES

Quality is that often "HIDDEN" but ever present characteristic in AURORA pumps that provides long-term top performance. It is the sum of design features, experienced material selection, and craftsmanship.

STAINLESS STEEL SEALS for maximum corrosion resistance . . . straight-shaft impeller mounting provides positive impeller-to-shaft lock . . . STAINLESS STEEL MOTOR SHAFT . . . positive drive on seal . . . CAST BRONZE IMPELLER is carefully balanced to insure MAXIMUM SMOOTHNESS AND QUIETNESS . . . vertical discharge provides for SELF-VENTING . . . LOW NPSH.

These "hidden" values make the *difference* in building complete satisfaction and customer acceptance.

You may also select from a complete line of close-coupled horizontal or vertical mounted pumps and flexible-coupled pedestal mounted pumps engineered to your specific requirements.

WRITE FOR BULLETIN 119 PKG-A

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THE NEW YORK AIR BRAKE COMPANY
650 LOUCKS • AURORA, ILLINOIS

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RECENT TRADE LITERATURE

Continued

▶ *PIPE LINE NOISE CONTROL*—Bulletin describes how "Quiet-Flex" rubber pipe connections used to control water line noises, isolate equipment vibration, reduce water hammer, simplify alignment problems. Complete descriptions, specifications given in publication. *Vibration Mountings, Inc., Dept. HPAC, 98-15 50th Ave., Corona 68, N. Y.*

▶ *PLASTIC PLUG VALVE*—New 4 page chemical resistance data sheet lists alphabetically the chemical resistance of plastic and synthetic rubber materials of construction for manufacturer's gate valves to 256 corrosive fluids with corresponding temperature and concentration data. Valves available in sizes ½ through 2 in. *Vanton Pump & Equipment Corp., Div. of Cooper Alloy Corp., Dept. HPAC, 201 Sweetland Ave., Hillside, N. J.*

▶ *PUMPS*—Bulletin "B-1300" describes line of pumps capable of handling water, other non-abrasive liquids in quantities to 70,000 gpm. "Type A" pump characteristics permit pumping against heads to 400 ft and handling, with modification, liquids of temperatures to 300 F. Bulletin has cutaway sectional views, cross section drawings, complete dimensional, performance data and sample specifications. *Peerless Pump Div., Food Machinery and Chemical Corp., Dept. HPAC, 301 W. Avenue 26, Los Angeles 31.*

▶ *PVC PIPE, VALVES*—"Koroseal" line of polyvinyl chloride piping, fittings, valves — covering both normal and high impact material — is subject of catalog "No. 10050-A." Catalog lists complete specifications, physical properties of piping, and includes application data. Material said to retain impact strength, corrosion resistance over wide temperature range. *B. F. Goodrich Industrial Products Co., Plastic Products Div., Dept. HPAC, Marietta, Ohio.*

Radiant Ceiling News

With Burgess-Manning Ceilings — Your Building Is Better — Your Building Budget No Bigger

Fuel Cost Lowered, Sickness Absenteeism Reduced... with Radiant Acoustical Ceiling

In 1955, when architects Beatty and Berlenbach recommended a Burgess-Manning Radiant Acoustical Ceiling for the proposed West Middle Island Elementary School of Middle Island, N. Y., the Board of Education of the Union Free School District was frankly sceptical. Only after making an inspection tour of a number of installations and hearing the enthusiastic reports of owners and occupants, were they convinced that such a ceiling could be feasible and practical.

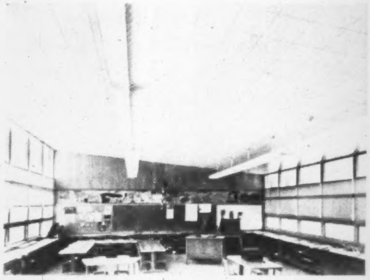
In due time the West Middle Island Elementary School was completed, with its Burgess-Manning Radiant Acoustical Ceiling installed.

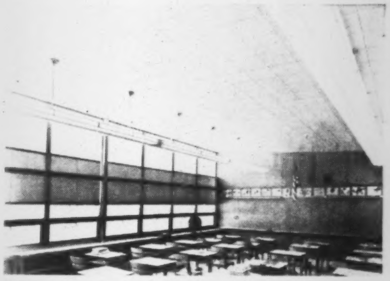
The results—the following excerpts from a letter by Donald H. Fingar, School Board President, written after a year of operation, will tell the story:

"The system has been efficient, fast, and flexible of control with no uncomfortable areas. Our fuel consumption has been substantially less per cubic volume than neighboring schools with "modern" radiant convectors. — Our kindergarten conducts games and rest periods on the floor, a concrete slab, with no apparent discomfort. Our incidence of lost time due to colds and other respiratory troubles has been considerably less since moving from a building with radiant convectors to our present Burgess-Manning installation.

We believe this to be the ultimate in heating and acoustical comfort —"

Our thanks to Mr. Fingar, — any additional comment would be superfluous.





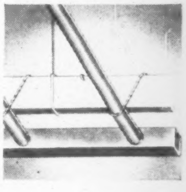
Radiant Acoustical Ceiling Basically Simple In Design

Considering the triple function performed by the Burgess-Manning Radiant Acoustical Ceiling, its construction is amazingly simple and compact, and is easily erected. It consists of only 4 major parts.

1. Suspension Grid

The suspension grid of 1½" channels on 4 ft. centers is not unusual.

2. Water Circulating Coil



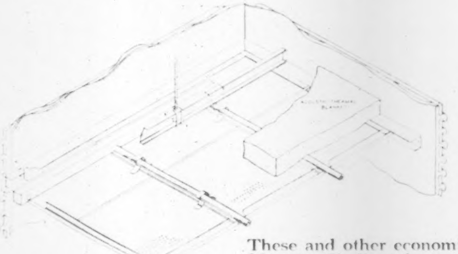
The grid type coil is made from pre-fabricated headers to which ½" laterals are welded. A sinuous type coil can be used where conditions make it desirable. It hangs from the suspension grid.

3. Acoustic-Thermal Insulation Blanket

The non-combustible sound-absorbing blanket, with the required noise reduction coefficient, is laid on top of the suspension grid.

4. Snap-On Panels

Heavy gauge perforated aluminum panels of the proper thermal conductivity are attached directly to the water circulating coil.



This isometric drawing shows all 4 parts assembled — a relatively simple construction that replaces the conventional radiators, or hot air ducts used for convectional type heating, and that permits reduction in size of air handling equipment such as blowers, fans, coils, filters, etc.

These and other economies permit installation of Burgess-Manning Radiant Acoustical Ceiling at a cost equal or lower than would be paid for various combinations of convection heating and air cooling, plus a suspended acoustical ceiling.

Write for descriptive Burgess-Manning Catalog No. 138-2H

3 Heating Cooling Acoustical

BURGESS-MANNING COMPANY

Architectural Products Division

5970 Northwest Highway, Chicago 31, Ill.

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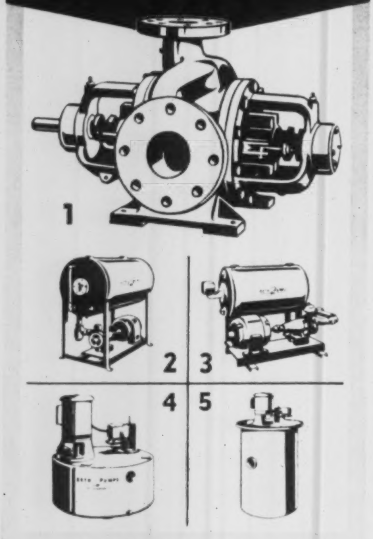

1 — Two Stage Turbine Pumps
2 — Boiler Feed Units
3, 4, & 5 — Condensate Units

HERE'S WHY! *more and more heating engineers specify* **ROTH**

To the engineer, the name ROTH means a full selection of one and two stage, high and low pressure condensate pumps; packaged boiler feed units; and packaged condensate return units — all designed to meet the most exacting specifications and built to give maximum life and performance . . . Complete, easy-to-choose selection data saves time and error in writing specifications.

HERE'S WHY! *jobbers find that it pays to handle* **ROTH**

Wholesalers find that it pays to handle a nationally recognized quality like ROTH — the name that more and more engineers are writing into their specifications. It will pay you to investigate the sales and service opportunities offered by this AAA-1 company.

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Jobbers — be ready to answer your local contractors' questions on ROTH equipment and prices. Find out about ROTH sales policy and factory assistance. Catalog gives complete, easy-to-find selection and price data on ROTH power plant pumps and equipment. (Extra copies available for jobber distribution.) Your registered copy will be kept up-to-date by an automatic catalog mailing system. Copies also available to contractors and engineers.

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TURBINE PUMP DIVISION
2452 Fourth Avenue
Rock Island, Illinois

RECENT TRADE LITERATURE

Continued

▶ *REGISTERS, GRILLES*—"Auer Engineering File" is 60 page brochure containing detailed engineering data on registers, grilles for heating, air conditioning, combination heating-cooling. File includes engineering information, performance data, tables, selection charts, sizing data, dimensional drawings suitable for submittal and rough-in calculations. Cross-reference table of commercial registers, grilles showing style numbers, descriptions of all known manufacturer's lines also included. *Auer Register Co., Dept. HPAC, 6600 Clement Ave., Cleveland 5.*

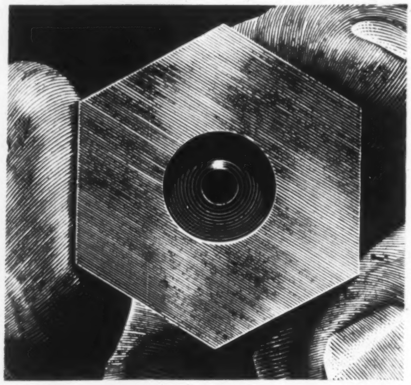
▶ *ROTARY PUMPS*—Bulletin "No. 1535" covers general purpose, industrial, internal gear rotary pumps. Discussion of operation, construction of pumps included, together with complete list of applications, capacities, rpm tables. Complete dimension table with diagrams appears on back page. *Deming Co., Dept. HPAC, 14 Aetna St., Salem, Ohio.*

▶ *ROTARY PUMP*—Bulletin "No. 1550" gives details on new line of heavy duty internal gear rotary pumps, with capacity ranges to 1000 gpm. Typical application data, specifications, operation and construction features included. Installation diagram also provided. *Deming Co., Dept. HPAC, 14 Aetna St., Salem, Ohio.*

▶ *SINGLE PHASE MOTORS*—Bulletin "No. 470-B" presents new, expanded line of company's integral hp single phase motors available in ratings 3/4 to 20 hp. Tabulated ratings, dimensions, weights given in publication. *Robbins & Myers, Inc., Motor Div., Dept. HPAC, 1345 Lagonda Ave., Springfield, Ohio.*

▶ *SOUND INSTRUMENTS*—New circular gives full details on sound level meter, sound analyzer, other instruments. Publication is illustrated. *H. H. Scott, Inc., Sound Instrument Div., Dept. HPAC, 111 Powdermill Rd., Maynard, Mass.*

Here's something you've never seen before!



NEW Carrier "CANT-CLOG"* SPRAY NOZZLE

Cuts maintenance costs on air washers, cooling towers and spray equipment

Proved in more than three years of service as standard equipment on Carrier air washers, this revolutionary new centrifugal type spray nozzle is now available as a replacement on all makes of spray equipment—as caps only or complete nozzles.

It's self-cleaning. It installs in seconds. It's low in cost. And since the orifice is formed in a flexible Buna-N rubber dome, erosion normally caused by restricting particles is eliminated. You get longer nozzle life, less down-time and better equipment performance.

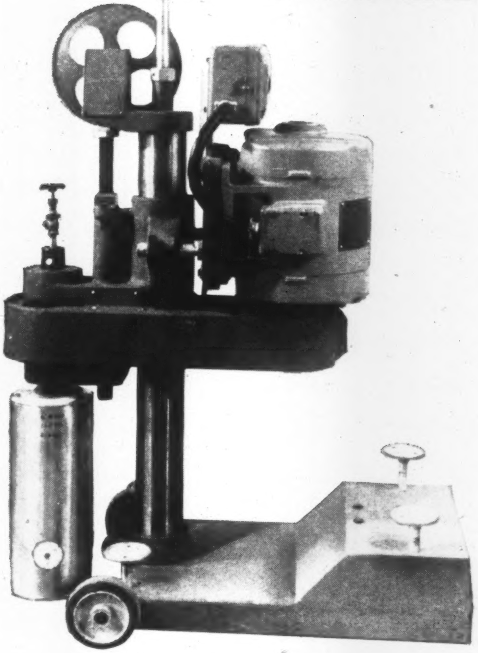
For ratings and complete information on this money-saving new development, write Carrier Corporation, Syracuse, N.Y.

* Patent Pending

Carrier

POWER + SPEED
WITH THE

Model II MOLE



Drills through hard reinforced concrete where production jobs make you money. The extra power gives longer bit life.

3 H.P. Single Phase 110/220V. Electric Motor Max. Hole Size 6″
5 H.P. 3 Phase 220/440V. Electric Motor Max. Hole Size 8″

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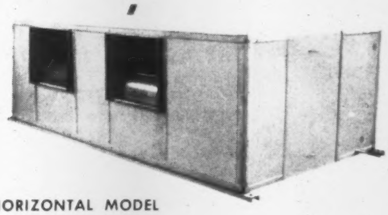

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THE BEST OF PROVED-BEST FEATURES 'N SOME NEW ONES, TOO: SECTIONALIZED CONSTRUCTION. FULL ACCESS TO ALL EXPOSED AREAS. FRAME, STRUCTURAL STEEL ANGLES, WELDED FOR RIGIDITY. FAN SECTION MAY BE FIELD-ROTATED. FANS, FORWARD CURVE, DIDW, CAST IRON CENTER HUB. EXTRA DEEP COIL SECTION CAN ACCOMMODATE 10-ROW COILS. DRAIN CONNECTIONS BOTH ENDS. INSULATED DRAIN PAN INDEPENDENT OF UNIT. SELF-ALIGNING, LIFETIME LUBRICATED BEARINGS. HIGH, LOW VELOCITY FILTERS. SEND FOR TIME-SAVER "FAN PERFORMANCE CURVES"

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FINNED TUBING
for Heating and Cooling

. . . The Greater-Heat-Transfer, Extended-Surface Tubing

★ known for performance since 1915 ★

- Tubes & Coils
- Individual finned tubing in standard sizes, square or round fins of any height or spacing
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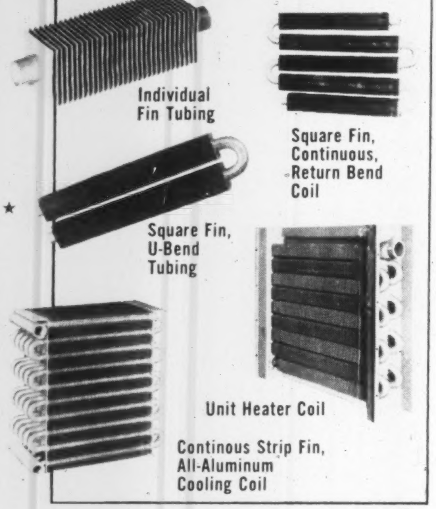
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"to transfer heat, G & O can't be beat"

THE G&O MANUFACTURING CO.
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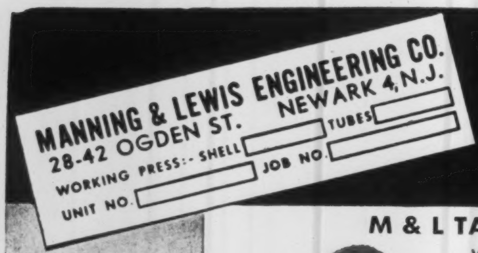
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WORKING PRESS:- SHELL
TUBES
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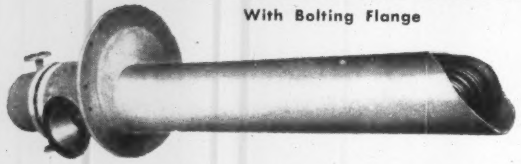
FUEL OIL HEATERS WATER HEATERS and COOLERS

M & L TANK OUTLET HEATERS
With Bolting Flange



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Heat Exchangers
Condensate Coolers
Heating Elements
Converters
Tank Heaters
Tankless Water Heaters
Instantaneous Water Heaters

FUNCTION: Installed in bulk storage tanks to prewarm viscous liquids (fuel oil, tar, road oil, molasses, lubricating oil or asphalt) that have been exposed to low temperatures.

CONSTRUCTION: Heads available in either cast iron or steel. Tubes of heavy gauge steel. Tube sheets and baffles of steel.

HEATING MEDIUM: Steam or hot water.

SPECIAL FEATURES: Economical to operate . . . only the liquid that is being withdrawn is heated. Special baffling assures greater efficiency. Can be bolted directly to nozzle. Special swing valve, as optional equipment, permits closing off the shell of suction heaters to enable removal of heads without emptying tank. (not illustrated).

For further details send for your copy of Bulletin #743.
Dept. "D"

Manning & Lewis Engineering Company
DESIGNERS & MANUFACTURERS OF QUALITY HEAT EXCHANGE EQUIPMENT
28-42 OGDEN STREET NEWARK 4, NEW JERSEY
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RECENT TRADE LITERATURE

Continued

▶ *STAINLESS VALVES*—Bulletin "No. 3" describes line of "Alloyco" 150 and 300 lb fully jacketed stainless steel valves designed for fluids difficult to move at room temperatures. All valves integrally cast in wide range of corrosive resistant alloys. *Alloy Steel Products Co., Inc., Dept. HPAC, 1322 W. Elizabeth Ave., Linden, N. J.*

▶ *STEAM GENERATORS*—Recently issued 20 page catalog "SB 60" covers manufacturer's complete line of steam generators and allied equipment. Cross section views of all major products provided to show design, construction. *Erie City Iron Works, Dept. HPAC, 1450 East Ave., Erie, Pa.*

▶ *TEMPERATURE CONVERSION TABLES*—Compact chart provides temperature-millivolt conversion tables for thermocouples. Chart said to make possible conversion of Fahrenheit or Centigrade temperatures, in 5 deg increments, to millivolt values for eight different thermocouple calibrations in matter of seconds. *Thermo Electric Co., Inc., Dept. HPAC, Saddle Brook, N. J.*

▶ *THERMOMETER WELLS*—"Thermowell Material Guide" offered to aid in selection of proper thermowell material for 325 different measuring applications. Recommendations include one or more materials for each application, take into consideration factors such as temperature, contamination, electrolysis, catalytic reaction, solution concentration, other variables. *Thermo Electric Co., Dept. HPAC, Saddle Brook, N. J.*

▶ *TIME SWITCHES*—Brochure describes how time switches can be incorporated into any type of heating system to make them automatic. Drawings showing wiring details are included, together with specific recommendations of type of switch to be used for application. *International*

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When the Plaza Hotel in Houston planned to modernize its air conditioning system, Thermal multi-zone units were chosen to assure the year-around comfort of the Hotel's transient and permanent guests.

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IN THE 1959 Dwyer INSTRUMENT MANUAL

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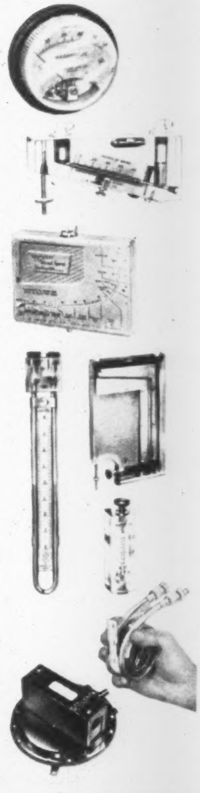

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- **Pitot Tubes** . . . inch-graduated, stainless steel.
- **Pressure-Actuated Switches**
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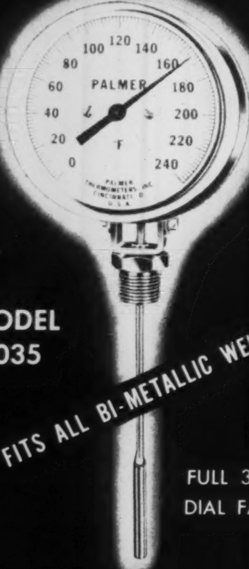
Outstanding
Accuracy
PALMER
Dial Thermometer



Check these functional features

- Direct-drive Bourdon Coil with a filled system for longer lasting accuracy.
- Stem can be placed at any desired angle and case can be rotated to most readable position.
- External calibration for zero setting.
- Unaffected by stem alignment.
- Accurate to one scale division.
- No sticking at any temperature.
- Non-corrosive case.

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Recording and Dial Thermometers
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RECENT TRADE LITERATURE

Continued

Register Co., Dept. HPAC, 2624 W., Washington Blvd., Chicago 12.

▶ *V-BELT DRIVES*—New 44 page bulletin "A-695" describes new line of V-belt drives. Illustrated with photos and engineering drawings, bulletin explains construction features of new "Dyna-V" sheaves and V-belts. *Dodge Mfg. Corp., Dept. HPAC, 500 S. Union St., Mishawaka, Ind.*

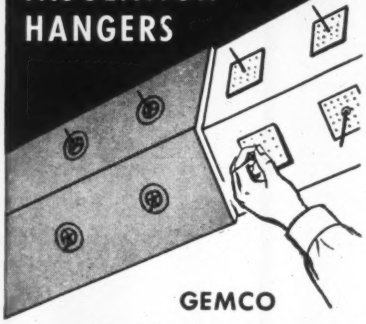
▶ *VALVES*—Illustrated, new 20 page bulletin "E-165" discusses valves for general services. Types, typical services, construction, operating features are covered. Includes drawings, photos, cutaways. *Everlasting Valve Co., Dept. HPAC, 49 Fisk St., Jersey City 5, N. J.*

▶ *VIBRATION CONTROL*—Data on control of noise and vibration transmission from air conditioning equipment through proper mounting is outlined in new bulletin, "Vibration Control for Air Conditioning." Includes illustrated vibration mounting selection guide cross-indexed according to type of equipment and its location. *Vibration Mountings, Inc., Dept. HPAC, 98-15 50th Ave., Corona 68, N. Y.*

▶ *WATER TREATMENT*—"Hi-Sep" dialysis system described in bulletin "WC-121." Bulletin covers design, operation, applications, advantages of "Hi-Sep Dialyzer." Comprehensive engineering drawings illustrate construction and operation. *Graver Water Conditioning Co., Dept. HPAC, 216 W. 14th St., New York 11.*

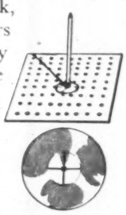
▶ *ZONE CONTROLS*—New brochure covers "Weather-Meter" system of zone temperature regulation. Operation, design of completely automatic system discussed in text, presented in drawings. Table of specifications also included. *National Controls, Inc., Dept. HPAC, 15 Brook St., Newton 58, Mass.* ⌖

SAVE TIME—
SAVE MONEY
with these dependable
INSULATION
HANGERS



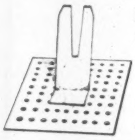
GEMCO
Spindle Hangers and
W-A Self-Locking Washers

Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed . . . with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.



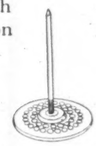
GEMCO Pronged Hangers

Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1³⁄₁₆" to 6⅞") bend over to hold insulation firmly in place.



TUFF-WELD Nylon Hangers

Two-piece hangers . . . with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.



TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
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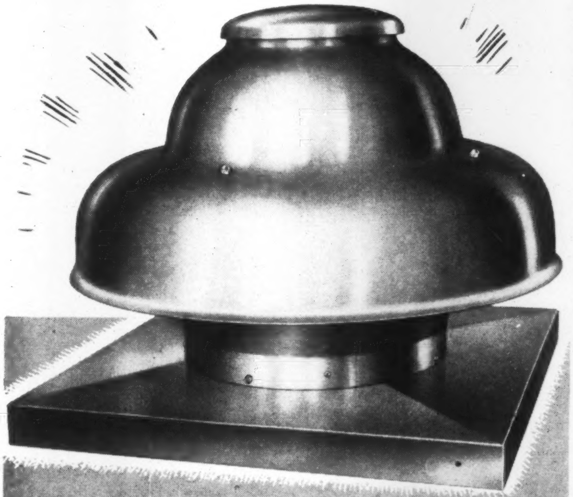
Aladdin

AIR HANDLING EQUIPMENT

Type "S" *Centrifugal* ROOF VENTILATORS



- **CERTIFIED RATINGS**
- **ALUMINUM HOUSED**
- **ATTRACTIVE DESIGN**
- **WEATHERPROOF**
- **QUIET OPERATION**

CERTIFIED RATINGS
AUTHORIZED BY
AMCA

ALADDIN Type "S" Roof Ventilators feature an attractive Spun Aluminum Housing of low contour. Designed especially for those installations which require a small powered exhaust unit. The Type "S" Roof Ventilator is ideally suited for schools, hospitals and similar type buildings.

Seldom requiring maintenance, these units are furnished with unusually quiet, fan cooled motors with outstanding lubricating systems, assuring long, continuous service under severe conditions of dust and dirt.

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ALADDIN HEATING CORPORATION
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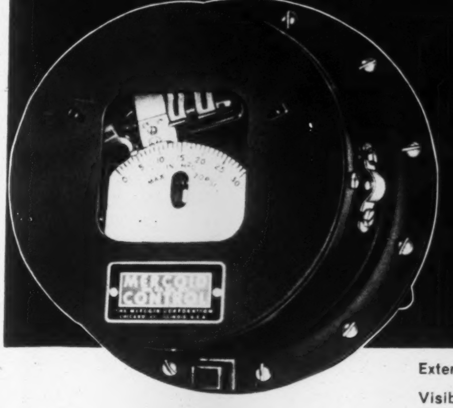
MERCOID

LOW PRESSURE CONTROL

FM APPROVED
GAS PRESSURE CONTROL

FOR GASES OR AIR



External adjustment
Visible calibrated dial

CAN BE USED THREE DIFFERENT WAYS

For operation as a

POSITIVE PRESSURE CONTROL
NEGATIVE PRESSURE (VACUUM) CONTROL

DIFFERENTIAL PRESSURE
(POSITIVE OR NEGATIVE PRESSURES)

This control employs a diaphragm which actuates a mechanism for opening or closing a mercury switch. The diaphragm separates two pressure chambers, one of which may be used for positive pressure; the other for negative (vacuum) operation or both chambers may be used to provide operation due to a difference in pressures between them.

OPERATING RANGE: 1.0" to 30.0" (H_2O)
MAXIMUM PRESSURE: 20 Psig

FIXED DIFFERENTIAL (SENSITIVITY)
When operating point is set at

LOW	MEDIUM	HIGH
0.6"	0.8"	1.0"

TYPES AVAILABLE

FULLY AUTOMATIC OPERATION: sp-st circuit opens on increase of pressure, vacuum or differential pressure; or sp-st circuit to open on decrease, (Available sp-dt or dp-st.)

SEMI-AUTOMATIC OPERATION (With Manual Reset): Available to operate automatically on decrease or increase.

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NEW YORK OFFICE: 205 EAST 42nd ST.
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More than 100 International-LaMont
HIGH TEMPERATURE WATER GENERATORS
(Total hourly capacity over two and one-half Billion Btu)

All of these users saved 15-18% in installation costs alone over comparable high pressure steam systems — and they are continuing to save 13-20% in operating costs and 50-60% in maintenance costs. These same savings can be yours.

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THE INTERNATIONAL BOILER WORKS CO.

Steel Firebox Heating & Power Boilers Low & High Pressure Water Tube Package Boilers • International-LaMont Forced Recirculation Generators • ASME Code Pressure Vessels & Welded Products.

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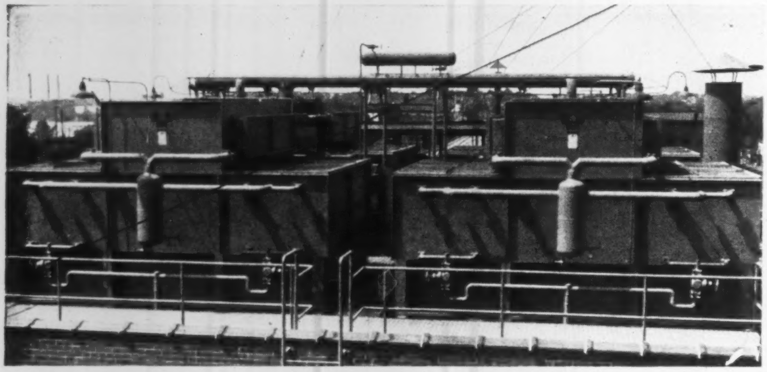
Manufactured in Canada by Canadian Vickers, Ltd., Montreal, P. Q.



GET TROUBLE-FREE CONDENSING AND GREAT POWER AND LABOR SAVINGS

NIAGARA AEROPASS CONDENSERS give you trouble-free, automatic refrigeration at the least spread between head-pressure and suction pressure. You gain a great power saving. You also get removal of superheat before condensing, condensing at subcooled temperature and a refrigerant fully purged of oil. Out-door air takes up heat of condensation through evaporation of the least amount of water; low temperature condensing means freedom from scaling and loss of capacity. Niagara sectional design offers you lower costs for more compact equipment, easier to keep up. You get always full capacity, "new plant" efficiency and continuous savings such as 95% of condensing water cost that add to your profit. Managers who know their costs buy Niagara Aeropass Condensers.

Write for Bulletin 131

NIAGARA BLOWER COMPANY
Dept. HP-5, 405 Lexington Ave., New York 17, N.Y.
Niagara District Engineers in Principal Cities of U. S. and Canada

WHO'S WHAT . . .

(New personnel, promotions)

▶ *MARLEY CO.*—Leon T. Mart, elected chairman of board of directors; Joseph A. Cameron, Jr., elected president; Maynard A. Patton, vice president and eastern regional sales director.

▶ *GRISCOM-RUSSELL CO.*—Kenneth B. Ris, chief executive officer.

▶ *STANFORD RESEARCH INSTITUTE*—E. Finley Carter, president; Weldon B. Gibson, vice president.

▶ *METALS & CONTROLS CORP.*—Edward O. Vetter, executive vice president.

▶ *W. H. NICHOLSON AND CO.*—J. Milton Scattergood, financial vice president and director.

▶ *GUSTIN-BACON MFG. CO.*—F. W. Muller, vice president and general sales manager.

▶ *JAS. P. MARSH CORP.*—Robert E. Barnett, vice president for sales.

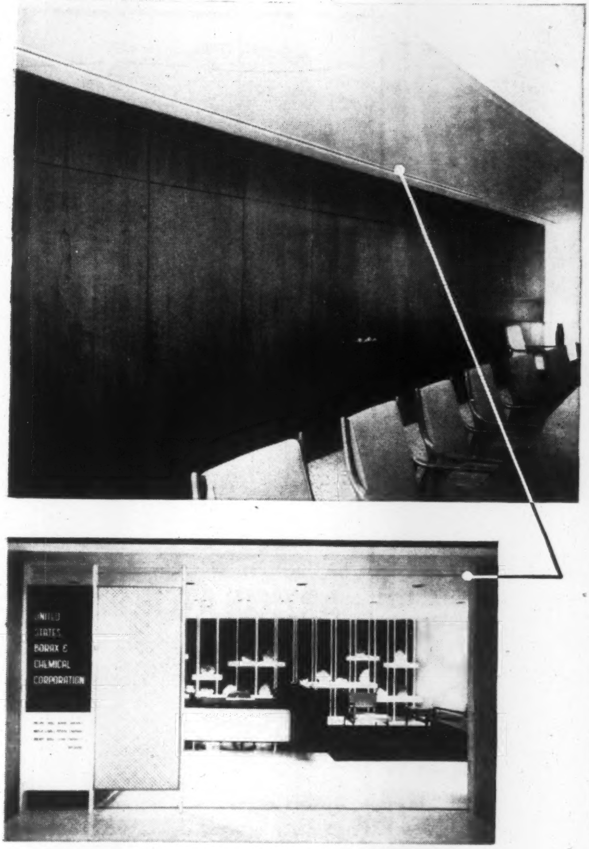
▶ *YORK DIV.* of *BORG-WARNER CORP.*—Emil Peslar, vice president of operations; David A. Schrom, works manager of Grantley Works.

▶ *AMSTAN SUPPLY, DIV.* of *AMERICAN-STANDARD*—C. Gilmore Ruston, vice president, field operations.

▶ *ANSUL CHEMICAL CO.*—Jay H. Jarret, sales vice president; Richard W. Drebus, director of marketing and administrative services; Edward A. Beacham, manager of refrigeration sales department.

▶ *RANCO, INC.*—R. R. Forrester, Jr., president of *WILCOLATOR CO.*, appointed to board of directors.

▶ *MINNEAPOLIS-HONEYWELL REGULATOR CO.*—Fred Maytag, II, president of the Maytag Co., elected to board of directors.



Designer:
Maria Bergson Associates

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Distinctive SLOT TYPE Diffusers

Look around . . . you'll see STRIPLINE by AGITAIR everywhere. And no wonder. STRIPLINE combines the best features of both slots and efficient air diffusers to provide equalized air flow throughout its entire length.

Slender, inconspicuous, practical and versatile . . . STRIPLINE slot diffusers can be located in walls, ceilings, coves, moulds, window reveals, stools . . . yes anywhere to suit interior design.

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high velocity units • punkah louvers
air diffusers • filters • exhausters

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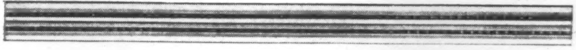
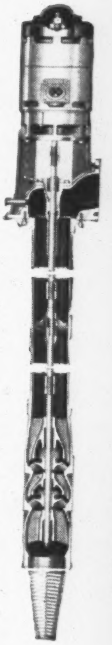
Type H



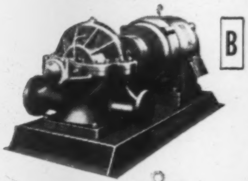
DO YOU FIND YOUR PUMP PROBLEM HERE?

A	Water Supply Air Conditioning Refrigeration Cooling Towers Sump Pumping, Etc.	**B**	Booster Service Cooling Towers Water Treatment Water Circulation Brine Service, Etc.
C	Hot Water Circulation Ice Water or Brine Clear Water Boilers Booster Service, Etc.	**D**	Hot and Cold Liquids Refrigerants Boiler Feed Cooling Towers

Then You'll Find Your Best Answer Here—

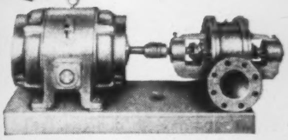


A **F-M Pomona Water-Lubricated Turbine Pumps** Easily installed, easy to adjust for varying field conditions. Available with wide choice of drivers.



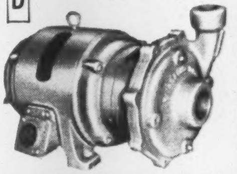
B **F-M Split-Case Centrifugal Pumps** Capacities, pressures and sizes for any requirements. Single-stage or multistage.

C



F-M Westco Peripheral Pumps Capacities to 200 gpm. Pressures to 900 ft. Sizes 1½" through 2½". Horizontal single-stage or multistage. Develops high pressure at normal operating speeds.

D



F-M Builtogether Centrifugal Pumps Capacities to 900 gpm. Pressures to 525 ft. Sizes ¾" through 5". Single-stage or multistage.

***FREE!* Expert Engineering Help at Your Service**

Be *sure* of low-cost, foolproof pumping installations that match your exact requirements . . . call in your Fairbanks-Morse Sales Engineer. Take advantage of his broad technical background and expert knowledge of pumps for air conditioning, plumbing and heating. Call him today, or write Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Illinois.

See Sweet's Product Design Catalog File
for complete F-M Pump Line.

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a name worth remembering when you want the BEST

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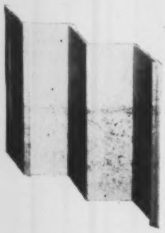
RAIL CARS • HOME WATER SERVICE EQUIPMENT • MAGNETOS

SOPLASCO
PLASTIC
MOISTURE ELIMINATOR BLADES
for
Industrial Air-Conditioning
are
CORROSIVE RESISTANT

SOPLASCO Plastic Moisture Eliminator Blades solve the problem of corrosion! Blade replacement is unnecessary for reasons of corrosive degradation. Greater efficiency is guaranteed due to the outstanding physical and chemical resistance of SOPLASCO Plastic Blades. Insist on SOPLASCO Blades in your specifications and when your ordinary blades need replacing.



For further information write, wire, or phone SOPLASCO AIR PRODUCTS DEPT.

Southern Plastics Co.

408 Pendleton St.
Columbia, S. C.

WHO'S WHAT

Continued

▶ *AMERICAN MACHINE AND METALS, INC.*—I. Newton Becker, executive vice president, elected to company's board of directors.

▶ *WARREN PUMPS, INC.*—Earl C. Hughes, president of *BAY STATE ABRASIVE PRODUCTS CO.* and David M. McIntosh, Jr., executive vice president of *CHAPMAN VALVE MFG. CO.*, elected to company's board of directors.

▶ *BUFFALO FORGE CO.*—John H. Gregory, executive vice president of the *CANADIAN BLOWER & FORGE CO., LTD.*, and *CANADA PUMPS, LTD.*, subsidiaries, named to the board of directors of the parent company.

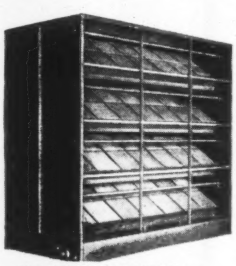
▶ *AIR FILTER INSTITUTE*—E. F. Burow, president; E. F. Snyder, first vice president; W. B. Watterson, second vice president; Arthur Nutting, secretary-treasurer.

▶ *VIKING AIR PRODUCTS DIV., NATIONAL-U. S. RADIATOR CORP.*—John Thibo, advertising manager; supervisor of sales.

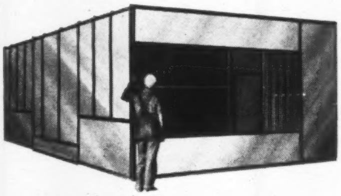
▶ *POWERS REGULATOR CO.*—Fred J. Knight, planning manager; T. J. Smith, specialty sales manager.

▶ *KEASBEY & MATTISON CO.*—Royal Mattison, Jr., manager of power and controls group in the engineering department; Lee Z. Wilkins, sales service manager; Michel Gochtovtt, design manager; George J. Goll, government representative; Daniel Shoemaker, assistant to general sales manager of sales division; Walter M. Deckman, general sales manager of industrial products division; Frank Q. Chambers, New York district manager.

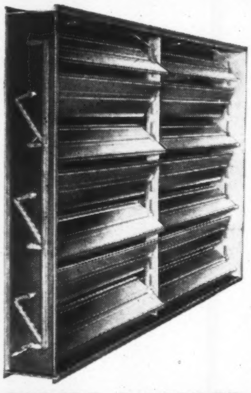
▶ *CARRIER CORP.*—Frank E. Purcell, sales manager of packaged equipment for the unitary equipment division.



CAPILLARY ® Air Washers



ARTICULATED UNITS



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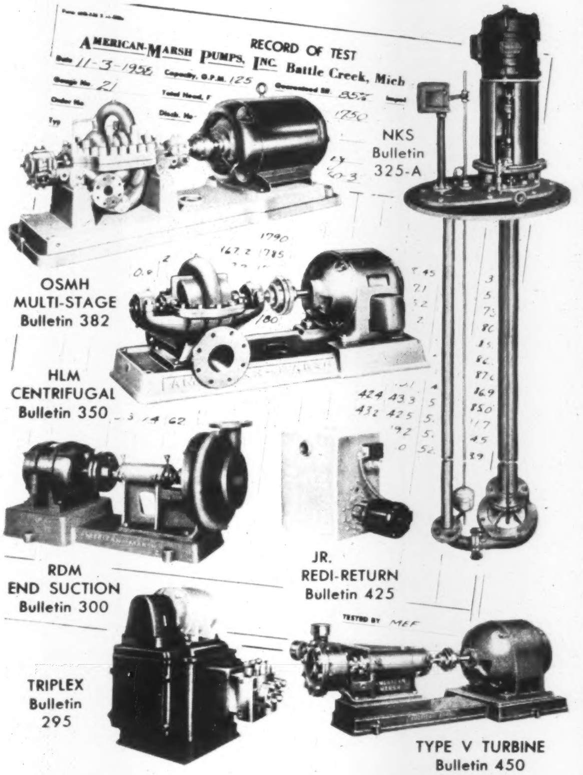
AMERICAN-MARSH PUMPS, INC.
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EVERY INDIVIDUAL PUMP BUILT BY AMERICAN-MARSH IS TESTED IN OPERATION!

You can be sure your pump is *right for the job* when you buy from American-Marsh! For now—as always—every individual pump we build is tested in operation before shipment. Further, an individual written record is made of each centrifugal pump test and kept on permanent file.

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For you, these tests assure outstanding performance and long, trouble-free service. For us, they assure your continued confidence in American-Marsh Pumps.

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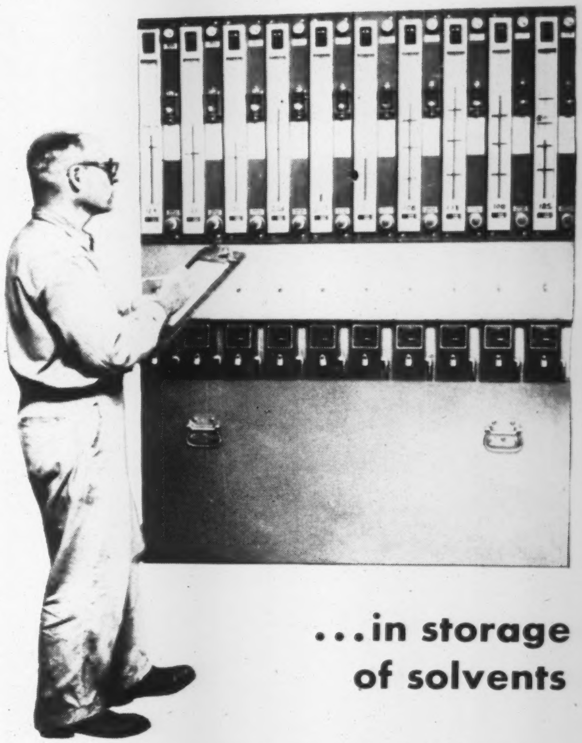
Pumps and Pumps only Since 1873 - Representatives in all principal cities
CENTRIFUGAL, TURBINE, STEAM AND POWER PUMPS FOR PROCESSING, AIR CONDITIONING, BOILER FEED, TESTING, ETC.



...in storage of solvents

PETROMETER INDICATORS SOLVE INVENTORY & SAFETY PROBLEMS

Gotham Ink & Color Company, Long Island City, N. Y. found the answer to its solvent storage and handling problems in an underground tank system equipped with Petrometer remote reading Liquid Level Indicators and Petrometer Safety Cleanout Valves.

The solvents, toluol, ethyl acetate, petroleum spirits, etc. were formerly supplied in 55 gallon drums, which required expansive storage space and considerable handling. Today all solvents are stored underground. The Petrometer Indicator on each tank provides visual, up-to-the-minute record of tank contents. The Safety Cleanout Valve permits safe, vapor-tight access to the tank bottom for removal of water and sludge or for emptying the tank for a change of solvent.

The entire system has been approved by Underwriters Laboratory, Factory Mutual and the New York Board of Standards and Appeals.

For information on Petrometer Indicators and Control Systems, write for Bulletin 6004A.

Petrometer
LIQUIDEPTH INDICATORS

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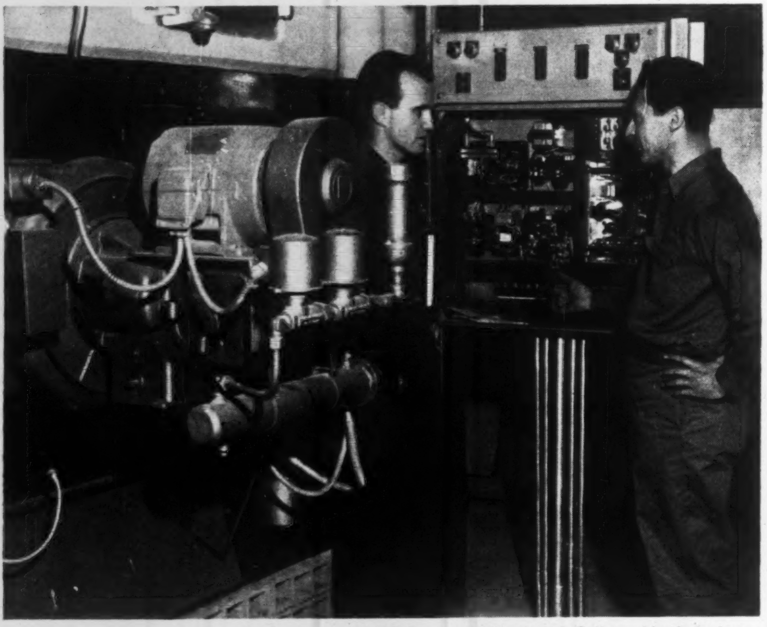
***ENTERPRISE* Burners give Merrimack College Top Performance with Truly Full-Automatic Heating**



Two Enterprise Model K-3 Burners at Merrimack College, North Andover, Mass., burning No. 6 oil and rated at 46,000 sq. ft. steam output.

Users, Engineers, Contractors—all agree:

"Everyone Benefits When It's an Enterprise"

Modern building plans call for the latest in oil burning equipment—for economy, efficiency, and continuous operation with minimum supervision and maintenance.

That's why Enterprise Full-Automatic Burners, with exclusive P. D. Metering Pump and complete automatic controls, were selected for the 42,500 sq. ft. steam E. D. R. firebox boilers in Merrimack College's new power plant.

Burning No. 6 fuel at 103 gph maximum, these burners heat two buildings of a million cubic feet, and have the capacity also to heat two new buildings of equal size when completed.

Whatever the heavy duty commercial or industrial application, look to Enterprise for the finest in a complete range of oil and combination oil and gas burners from 4 to 200 gph. Complete information and illustrated specification sheets available on request.

- Architect: *John Hefferman*
- Design Engineers: *Reardon & Turner*
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- Heating & Piping Contractors: *M. J. Flaherty Co.*
- Installed by: *Enterprise Oil Burner Sales Co., Boston*

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ENTERPRISE ENGINE & MACHINERY CO. • 18TH AND FLORIDA STS., SAN FRANCISCO, CALIFORNIA

WHO'S WHAT

Continued

▶ *DRAYER-HANSON, DIV. of NATIONAL-U. S. RADIATOR CORP.*—William Keichline, assistant to general manager; Irvin Secord, sales manager for air conditioning and refrigeration products.

▶ *WALWORTH CO.*—John Alico, manager of manufacturing.

▶ *LINDE CO., DIV. of UNION CARBIDE CORP.*—Clarence E. Jackson, staff engineer, presented the Adams Lecture at the 40th annual meeting and welding show of the *AMERICAN WELDING SOCIETY*.

▶ *DETROIT CONTROLS DIV. of AMERICAN-STANDARD*—John R. Warnock, general manager of marketing; Louis Szerecsen and Don L. Lewis, headquarters specialists in sales department.

▶ *JOSEPH T. RYERSON & SON, INC.*—John A. Houston, general manager of Dallas plant; Melvin B. Monson, general manager of company's plant at Los Angeles; Charles S. Hegel, general manager of Milwaukee plant; H. Daniel Robb, national product manager for stainless steel; Edward J. Richardson, to assume duties as national product manager for alloy steel in addition to tubing and cold bars; Edward J. Byers, manager of general order department; Joseph A. Moran, sales manager of Boston plant; Arthur B. Burke and Napier B. Caldwell, district sales managers for Boston plant.

IN THE TERRITORIES . . .

(Recent sales appointments)

▶ *CHICAGO NIPPLE MFG. CO.*—Jack Ross, Baltimore and Boston representative.

▶ *SPENCER DIV., METAL & CONTROLS CORP.*—Robert G. Metzger, field engineer in western Michigan.

Write for new
Bulletin!

WILSON
CENTRIFUGAL BLOWDOWN SEPARATOR

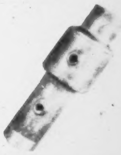
SOLVES BOILER BLOWDOWN DISPOSAL PROBLEMS

Here is the safe, economical way to handle boiler blowdown . . . at atmospheric pressure. Steam flash is instantaneously cleared through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectionable noise. Install where convenient, inside or out—even on boiler room roof. One Wilson Separator can handle two or more boilers in battery, if desired. Special models with flanged or butt welding connections available.

- MEETS REQUIREMENTS OF A.S.M.E. UNFIRED PRESSURE VESSEL CODE
- SIMPLE TO INSTALL
- REQUIRES NO MAINTENANCE
- THOUSANDS IN SERVICE

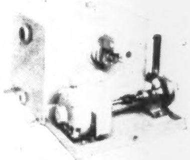
NEW 2½" AFTERCOOLER FOR HOT LIQUIDS

Effectively reduces temperature of blowdown before entering sewer. Easy to install. Requires no special connections.

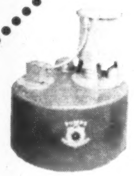


WILSON ENGINEERING CORPORATION

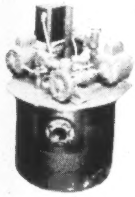
6 North Michigan Avenue Dept. H-7 Chicago 2, Illinois



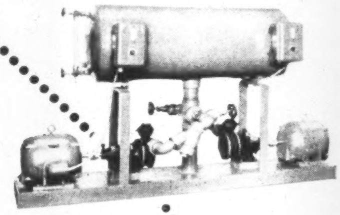
EAGAN EAGLE —For steam heating loads up to 8000 sq. ft. at 20 p.s.i. Does not require pit even though return lines are no more than one foot above the floor.



EAGAN HOT POT —Vertical submerged type pump with cast iron receiver. Motor and pump above receiver safe from flooding. Single and duplex construction. Models for loads up to 15,000 sq. ft. at 20 p.s.i.



TYPE ECIV —Vertical pump and receiver for installations where return lines are below floor levels. Single or duplex units. Models up to 10,000 sq. ft. capacity at 60 p.s.i.



TYPE EC —Straight line arrangement requiring less floor space than necessary for competitive makes. Both pumps accessible for maintenance purposes. Single and duplex models designed for 2000 to 100,000 sq. ft. discharging against pressures of from 10 to 200 p.s.i.

EAGAN...

the complete line of Condensate Return Pumps

Eagan offers a full line of Condensate Return Pumps, and also manufactures Fuel Oil Pump and Heater Sets, Proportioning Pumps, Turbine Pumps and Centrifugal Pumps.

WALTER H. EAGAN CO., INC.

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Heating and Air Conditioning

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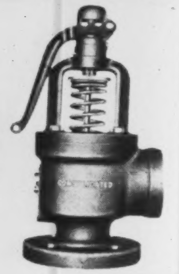
SAFETY VALVES
GIVE POSITIVE
PROTECTION



Type 1511 Safety Valve. Cast iron body. Maximum capacity for saturated steam. Sizes: 1½" through 6". Pressures to 250 psi. Temperatures to 450°F.

Make certain steam, air and gas pressures are held within safe limits on your heating, piping, and air conditioning projects. Consolidated Safety Valves automatically relieve overpressures in everything from package-type boilers and large steam generators to air tanks and other unfired pressure vessels. A 2100-pound design boiler is used to test and set these valves—to guarantee capacities and assure the best protection. Typical plus values of Consolidated Safety Valves are exemplified in the Type 1511:

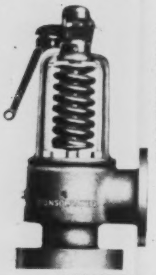
Compactness saves space and headroom; permits the use of smaller, more economical discharge piping.

Lower Cost per pound of steam discharged because maximum capacity is designed into minimum flange size. Fewer or smaller safety valves can be used on a boiler.

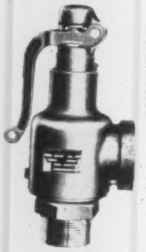
Better Alignment through double-guided adjusting ring and disc guide assures easier, more uniform blowdown adjustment and control, and finer operation.

Positive Tightness is created because the seat is machine-lapped to optical flatness.

On large or small installations, spring-loaded Consolidated Safety Valves give positive protection to personnel and facilities. Whatever the working pressures and temperatures of your heating, piping and air conditioning projects, choose Consolidated. Precision-made with few working parts, they are tough, long-life safety valves that rarely require maintenance. *Write for Catalog 700A.*



Type 1415 Safety Valve. Cast steel body. High capacity for saturated and superheated steam. Sizes: ½" through 6". Pressures to 900 psi. Temperatures to 900°F.



Type 1551 Safety Valve. Bronze body. For steam, air, gas. Sizes: ⅜" through 3". Pressures to 300 psi. Temperatures to 450°F.

ASME Standard • ASME Tested • National Board Certified

MAXWELL MANNING & MOORE INC. MM TRADE MARK

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A product of
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Consolidated Ashcroft Hancock Division • Stratford, Connecticut
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

▶ *SURFACE COMBUSTION CORP.*—Paul M. Hem, district manager for Great Lakes region of company's air conditioning and drying division.

▶ *ACME INDUSTRIES, INC.*—H. J. Rust, Jr., manager of new branch office in San Francisco; A. L. Mudicà, sales engineer in new San Francisco branch, serving Washington, Oregon, Colorado, Nevada, Arizona, Utah, Idaho, New Mexico, Montana and California; G. G. Partch, sales engineer for the Peoria, Ill., and southeastern Iowa territory.

▶ *OHIO BRASS CO.*—Manufacturers' agents and their territories: Ralph F. and Ashton D. Shoop, eastern halves of Connecticut and Massachusetts, all of Rhode Island, New Hampshire and Maine; Oliphant Commercial Corp., Oakland, Calif., northern California and parts of Nevada.

▶ *JENN-AIR PRODUCTS CO., INC.*—New representatives and their territories: O. M. Jones Co., Johnson City, Tenn., eastern Tennessee; R. E. Gardner Co., Nashville, Tenn., central Tennessee; Walter C. Strickland Co., Atlanta, state of Georgia.

▶ *BARRY BLOWER CO.*—New manufacturers representatives include: E. K. Strohan, Inc., New Orleans; Robert K. Stronach, Syracuse, N. Y.; Air Epuipment Distributors, Milwaukee; R. H. Spangler and Co., Inc., Memphis; Ralph B. Johnson & Co., Houston; Honolulu Electrical Products Co., Honolulu.

▶ *ORR & SEMBOWER, INC.*—M. T. Gossett Co., Inc., Nashville sales and service representative in Tennessee, northern Mississippi and northeastern Arkansas.

▶ *AMERICAN INSTRUMENT CO.*—Ernest Sturm, sales representative for Missouri and southern Illinois, with offices at 8768 Del Vista Dr., St. Louis.

▶ *DUNHAM-BUSH, INC.*—New sales representatives and their territories: Irvon E. Corwin, Peoria area; Harry F. Tuczynski, Syracuse territory; George F. McCain, Houston area; Robert T. Mitchell, southern New Jersey; Robert J. Bowen, Jr., Los Angeles; Warren Chrisinger, representative for Noel and Associates, Columbus; Fred Wenson sales engineer, Detroit; Harry Smith, Buffalo; Thomas Cantlin, Pittsburgh.

▶ *BLACK & DECKER MFG. CO.*—Walter Trapp, New York branch service manager; Dan E. Calabrese, assistant branch service manager of company's new Manhattan service branch at 227 Varick St., New York.

WHO'S WHAT

Continued

▶ *GRABLER MFG. CO.*—Armin J. Hascher, manager of Cincinnati branch.

▶ *DRAYER-HANSON, DIV.* of *NATIONAL-U. S. RADIATOR CORP.*—New sales agents include: Airtrol Supply, Inc., Corpus Christi, Texas; Rasco, Inc., Philadelphia; Sun Supply Co., Las Vegas; Sweiger-Davidson, Chicago; Temperature Supply Co., Billings, Mont., James O. Carter, Lynfield Center, Mass.

▶ *A. O. SMITH CORP.*—J. A. Snyder, manager of product service branch of new southeast office at 754 Miami Circle, N. E., Atlanta, Ga.; F. K. Toney, Atlanta district sales manager for *PERMAGLAS DIV.*; O. E. Reedy, Atlanta district sales manager of *SMITH-ERIE DIV.*; J. P. Thomas, Atlanta welding products sales representative.

▶ *TACO HEATERS, INC.*—Kendall Fiske, northern Illinois representative.

▶ *VIKING AIR PRODUCTS DIV., NATIONAL-U. S. RADIATOR CORP.*—Donald L. LeBlanc, district sales manager for New England territory.

▶ *COOLERATOR DIV., McGRAW-EDISON CO.*—New distributors include: Slakey Brothers, Sacramento, Calif.; Tennessee-Mathes Co., Nashville, Tenn.; Thermal Supply Co., Houston; Pioneer Metals Co., Miami; Johnson Distributors, Wichita, Kans.

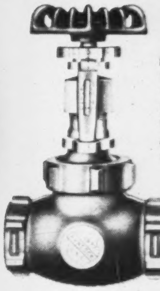
▶ *PENN CONTROLS, INC.*—Following district offices have been moved to different locations: eastern regional warehouses and New York district office consolidated at 1024 Edgewater Ave., Ridgefield, N. J.; Atlanta district office now located in Doraville, Ga., Box 306; Milwaukee district office now located at 4738 W. Lisbon Ave., Milwaukee 10. New Birmingham, Ala. district office located at 713 S. 59th St.; William P. Marshall manager of new district office. Joseph Chomel, district manager of Atlanta district office; Harold King, manager of Chicago district office.

▶ *INDUSTRIAL ACOUSTICS CO., INC.*—New representatives and their territories: Vernon S. Tupper Co., Nashville, Tenn.; E. M. Paullin, Inc., Buffalo, N. Y.; Ray F. Bauer Co., Wichita, Kans.; Heaven Engineering Co., Kansas City, Mo.; R. E. Pauling, Tulsa, Okla.

▶ *W. M. NICHOLSON & CO.*—B. W. Yocum, exclusive sales agent for New Jersey.

Heating and Air Conditioning
FLOW
CONTROL

HANCOCK
VALVES
DO THE JOB
ECONOMICALLY



Bronze "Flocontrol" Valves. ¼" thru 2". "500 Brinnell" stainless steel V-port disc. Variable orifice, shut-off and index in one valve.

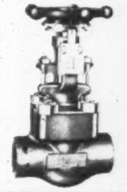
Reliable control of flow contributes substantially to complete owner satisfaction with every heating, piping, and air conditioning system you install.

Whether the application demands pin-point control of flow or full flow, Hancock Valve performance proves there is no substitute for the economy of quality. Highest operational perfection is combined with lowest maintenance. Whatever the piped medium – fuel oil, gas, water, or steam – the quality of Hancock Valves helps assure uninterrupted service. Typical advantages of Hancock Bronze and Steel Valves are:

RUGGEDNESS that continues to ward off the deteriorating effects of wire drawing, galling, steam cutting, erosion and corrosion long after ordinary valves fail.

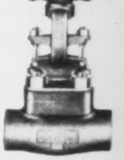
MAINTENANCE ECONOMY because carefully selected materials are precision-formed into functional parts of long-lasting efficiency. Servicing can be done in the line. Standardization of components means inventory economy.

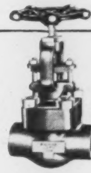
Learn all the job-proved reasons why Hancock Valves are today's best buy in terms of your standard of reliability. Globe, Angle, Gate, and "Flocontrol" types available with application characteristics suited to your heating, piping, and air conditioning requirements. *Write for Catalog 200A.*



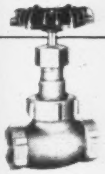
Steel "Flocontrol" Valves. ¼" thru 2". V-port disc compels proportional flow thruout the lift of the stem.

600# Steel Gate Valves. ¼" thru 2". Forged steel body. Maximum use of stainless steel.





600# Steel Valves. Globe and Angle. ¼" thru 2". Forged steel body. "500 Brinnell" stainless steel disc.



Bronze Valves. Globe and Angle. ¼" thru 2". "500 Brinnell" stainless steel seat and disc. 125% to 230% stronger diaphragm.

MAXWELL M&M MANNING & MOORE INC TRADE MARK
HANCOCK VALVES
A product of
MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Stratford, Connecticut,
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

WHO'S WHAT

Continued

▶ *JAS. P. MARSH CORP.*—Joseph T. Carpenter, sales representative in Cleveland office.

▶ *OLIN MATHIESON CHEMICAL CORP.*—Walfrid H. Johnson, district sales manager for *WESTERN BRASS.*

▶ *BINKS MFG. CO.*—Andrew Cummins, sales manager of Cleveland sales territory; C. J. Rood, sales manager of Indiana territory; Ed Cremer, export manager and regional manager of New York and New England areas; Robert Rorden, branch manager of New York City territory.

▶ *ROBERTSHAW-FULTON CONTROLS CO.*—Walter H. Morris, Midwest district sales manager for electrical controls; John C. Mevius, sales manager of Indiana division of the company; Benjamin D. Odom, Southern district sales manager.

▶ *AMERICAN AIR FILTER CO., INC.*—Two New York representatives, Paul H. Chartres, Albany, and William L. Jacobs, Schenectady, have merged their firms under the name, Air Equipment Co., Albany.

▶ *POWERS REGULATOR CO.*—J. R. Wilson, Chicago district manager; J. C. Scott, Chicago branch manager; Arthur Perlett, Denver branch manager; H. P. Spenner, Jr., contract sales supervisor in New York City; James J. Coady, Hartford branch manager.

▶ *ALLIS-CHALMERS MFG. CO.*—Bruce C. Halsted, manager of Richmond district.

▶ *BURNHAM CORP.*—William C. Wetherstine, Jr., sales representative in the Philadelphia, eastern Pennsylvania, southern New Jersey and Delaware territory.

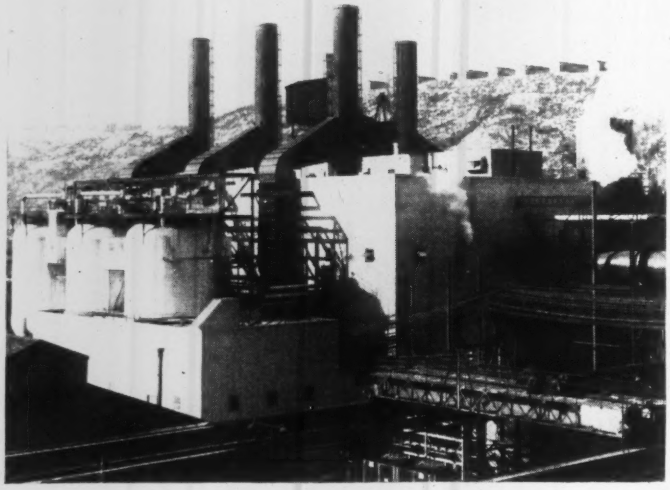
▶ *WHITE-RODGERS CO.*—H. A. Teasley, district manager for company's new Portland sales office at 2846-52 N. E. Glisan St., Portland 12. Kenneth W. Hill, sales engineer in San Francisco sales area, covering northern California and Nevada.

▶ *ZONOLITE CO.*—Concrete Thermal Casings, Inc., Evanston, Ill., to handle administration and sale of "Z-Crete" underground pipe.

▶ *A. M. BYERS CO.*—Randolph R. Gustafson, field service engineer in southeastern division; Union Supply Co., Durham, N. C., distributor; Brown Pipe & Supply Co., Albuquerque, N. M., distributor. ╪

Quick case history—reading time 52 seconds

How Hagafilm® eliminated $10,000 a year power plant corrosion costs



THE PLANT: Large power station serves U.S. Steel's National Tube Division at McKeesport, Pa. Monongahela River water is used for boiler make up.

River water is clarified with Hagan Coagulant Aid and alum, softened with lime and soda ash and deaerated for use in boilers. Desuperheating condensate system was forecast as corrosion weak spot because of high CO_2 in steam. To evaluate cost of maintenance versus treatment, National Tube engineers adopted a "wait and see" policy.

THE PROBLEM: Magnitude of corrosion was almost unbelievable. Standard 1″ x 2″ x 20 gauge carbon steel test strips pitted through within 24 hours. Low pressure heater shells had to be continually patched. Spill-over lines and fittings failed almost weekly. Maintenance costs rocketed to a high of $10,000 a year.

THE SOLUTION: Treatment with Hagafilm reduced corrosion rate from a no treatment level of 1285 to less than 1 mg/dm²/day with a 4 ppm feed; and to a range of 5 to 10 mg/dm²/day with a 2 ppm feed. Present practice is to feed at a rate of 3 ppm.

RESULTS: Since introduction of Hagafilm four years ago, no failures have occurred in spill-over system lines and fittings. Corrosion in entire desuperheating condensate system has been arrested.

National Tube engineers say that Hagafilm treatment has already paid for itself many times over in reduced labor and maintenance costs.

FOR FULL INFORMATION on Hagafilm, write for free Bulletin 410-12-7.

HAGAN CHEMICALS & CONTROLS, INC.

DIVISIONS: CALGON COMPANY, HALL LABORATORIES

HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto
European Division: Via Flumendosa No. 13, Milano, Italy

FOR **SIMPLIFIED**
INSTALLATION

AND **COMFORTABLE**
ROOM HEAT

USE **SHAW**
Panel-Vectors

Cut-open view of
Model A Panel-Vector

Shaw Panel-Vectors are of rigid, fully-integrated construction, delivered ready to install. There are no dampers or separate housings to fit and hang. Choice of same end or opposite end tapping offers opportunities for important piping simplification and economies.

Panel-Vectors distribute a *low-temperature*, unvarying combination of radiant and convected heat that only Nature—at her best—can rival. Stratification, and areas of extreme heat or chill are eliminated . . . room occupants are not only warm, they are *comfortably* warm.

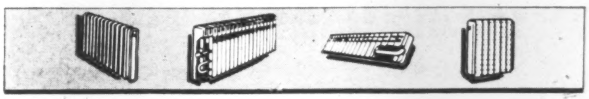
Shaw Panel-Vectors use hot water or steam up to 150 psi. They are available in wall-hung (panel) or baseboard models, each a space-saving 3″ deep. There is a full range of sizes to meet any room-heat distribution requirement.

Find out today about Shaw Panel-Vectors—the radiators that give you simplified installation, give the owner *comfortable* heat. Write for free literature on wall-hung and baseboard models.

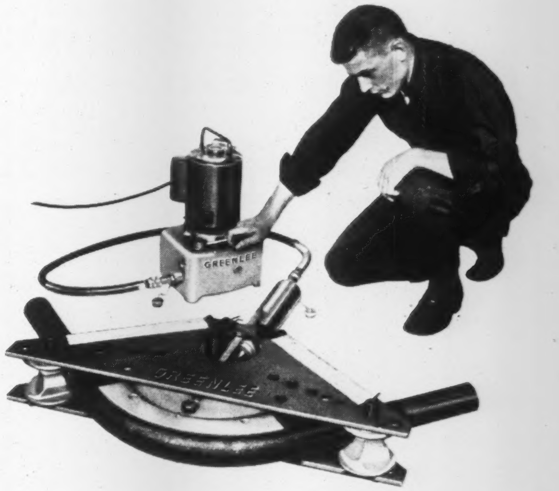
SHAW-PERKINS MFG. CO.

Properly Designed Room Heat Distribution Equipment

201 E. CARSON ST., PITTSBURGH 19, PENNA.



FAST, LIGHTWEIGHT
Hydraulic Pipe Bender
for 1/2″ - 3″ pipe



full 90° bend with one ram stroke

NEW GREENLEE No. 883 Bender saves hours, cuts costs on piping jobs. Gives you smooth, *accurate* bends right on the job exactly when and where needed. Has all these exclusive GREENLEE advantages for fast, easy *one-man* setup and operation:

- Bends these sizes of pipe: ½″, ¾″, 1″, 1¼″, 1½″, 2″, 2½″, 3″ . . . up to 90° with *one ram stroke*.
- Operates with either hand pump or portable power pump. Makes 90° bend in 3″ pipe in only 10 minutes with hand pump . . . only 3 minutes with power pump.
- One set of rotating pipe supports for all eight pipe sizes. (Pipe supports also serve as rollers for wheeling bender from job to job.)
- Positive-locking pipe support pins cannot come loose.
- Pipe is easily inserted and removed from *front* of bender. Special pipe removal pin for simple release of pipe after bending.
- Bending gauge included for accurate results with minimum calculations. Identical bends easily reproduced.
- Compact, lightweight, portable . . . operates in any position.
- High-strength aluminum and steel construction for minimum weight, maximum strength.

◀ **No. 884** Lightweight GREENLEE Pipe Bender for pipe sizes ½″ - 4″. Hand-pump or power-pump operated.

No. 880 Lightweight GREENLEE Pipe Bender for pipe sizes ½″ - 2″. Hand-pump or power-pump operated. ▶

GREENLEE LINE OF TIMESAVNG TOOLS FOR PIPE FITTERS AND PLUMBERS ALSO INCLUDES PIPE PUSHERS, HAND BENDERS, PLUMBERS' PIPE BITS, POWER BITS.

GREENLEE TOOL CO.

1769 Columbia Avenue, Rockford, Illinois

TOOLS FOR CRAFTSMEN
GREENLEE

WE HEAR THAT . . .

▶ A new warehouse-service center to serve northwest area industry has been established by *EUTECTIC WELDING ALLOYS, NORTHWESTERN DIV., INC.* The new center was opened recently at 2712 Second Ave., Seattle 1.

▶ Three integrated buildings totalling 142,000 sq ft were recently purchased by *ROBBINS & MYERS, INC.* Situated on 12 acres of land, the newly acquired facilities will house the sales, engineering, and manufacturing operations of the company's *PROPELLAIR INDUSTRIAL FAN* and *MOYNO PUMP* divisions.

▶ A $775,000 expansion program to increase ARMCO *STEEL CORP.'s* stainless steel output has begun at the company's Baltimore works. Included in the program is the installation of two new double ingot heating furnaces and three new heat-treating furnaces.

▶ *ASBESTOS-CEMENT PIPE DIV.* of *KEASBEY & MATTISON CO.* has announced the availability of a new sound-color 16 mm movie presenting the manufacture, and installation of the division's products. The film is available upon request from the company's district offices or through the company's advertising department.

▶ *AMERICAN METAL PRODUCTS CO.* has announced the purchase of *DAVIS ENGINEERING CORP.* The newly purchased firm will continue to operate with its present personnel under its new name, *DAVIS ENGINEERING, DIV.* of *AMERICAN METAL PRODUCTS CO.*

▶ *RIC-WIL, INC.* has announced plans to construct a new west coast plant. The new single story plant, which will be located at Sycamore St. and Central Ave. in Newark, Calif., will serve eleven western states.

▶ *HARRY ALTER CO.* has recently moved into its newly completed building in Dallas. Located in the Greater Dallas Trinity Industrial Area, at 2332 Irving Blvd., the new 8400 sq ft, one story building will serve as a display and storage area for the distributor's refrigeration and air conditioning supplies.

▶ *RIGIDBILT, INC.* has announced that its entire plant and office facilities are to be moved to 9240 Belmont Ave., Franklin Park, Ill. The new headquarters building is of steel construction without columns and with 14 to 20 ft ceilings. It provides 3000 sq ft of air conditioned office space.

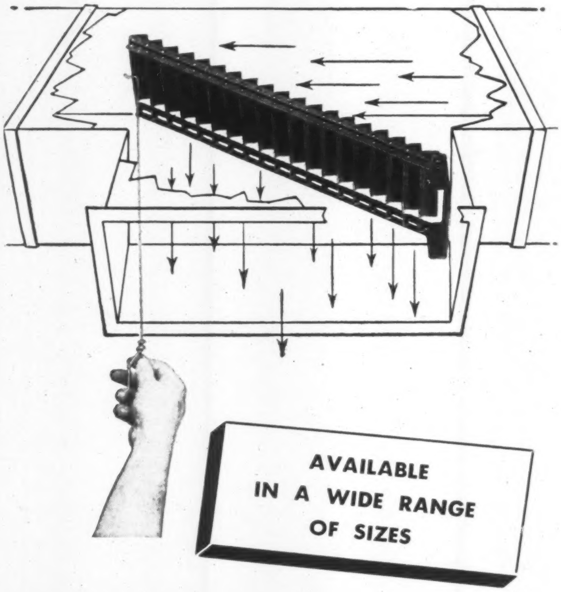
NOW . . . ***Divert Air Where You Want It!***

A-J

AIR "EXTRACTOR"

This new A-J Air Extractor gives you maximum control of any forced air system. It's not a "damper type" control to meter available air flow through a grille, but a "scoop" that diverts air from the main duct to branch ducts or grilles and increases output over normal flow where needed.

The curved steel blades of the A-J Extractor are adjustable and act in unison to provide a controlled and uniform flow of air into branch ducts. A single key rod provides fast and easy adjustment through the face of a grille or register, and eliminates need for removal. The extractor is sturdily constructed, and fastened in the duct with two screws. Velocity of the air will not alter setting. Write for full information and prices.

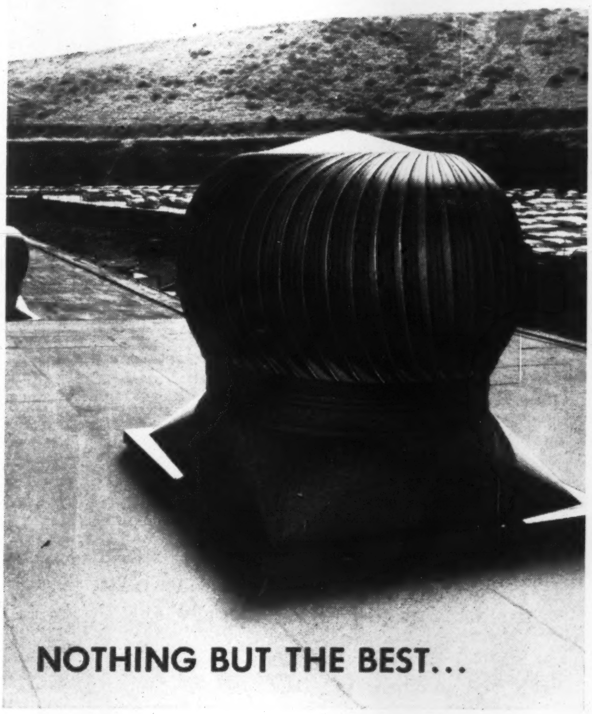


AVAILABLE IN A WIDE RANGE OF SIZES

FREE Catalog
listing, describing and pricing 1,000 types and sizes of grilles, registers, etc.

A-J MANUFACTURING Co.

3601 E. 18th St. **Dept. H-5** **Kansas City 27, Mo.**



Western Rotary® Roof Ventilators

with Lifetime Guaranteed Bearings

- "Backward curved blower wheel" type mechanism assures high, constant exhaust capacity, no backdraft ever.
- Certified wind tunnel tests by non-commercial national institute.
- Unique factory lubricated sealed bearings are specially designed for positioning load, countering wind pressure, assuring stability.
- Lock-on rotor, yet removable without special tools.
- Exclusive Western corrugated vane increases rigidity.
- Low, functional type adds beauty.
- Baked enamel paint coating for beauty and long life.
- Aluminum, copper, or stainless steel construction available.

Other type ventilators include:

- Stationary
- Directional
- Continuous ridge
- Vertical exhaust
- Axial roof
- Unit ventilators

Immediate Delivery on all sizes

Complete Catalog in Sweets and Western States A-E-C

Write for catalog and name
of nearest representative.

**WESTERN
ENGINEERING
& Mfg. Co.**

4108 Glencoe Avenue, Venice, California

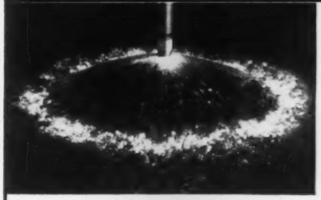
Since 1921 . . . a reliable leader.

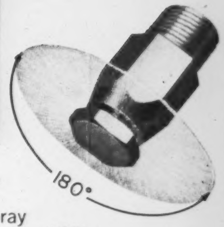
EXCLUSIVE* with Steinen

New Nozzles

*SPAN-JET

FLAT SPRAY NOZZLES

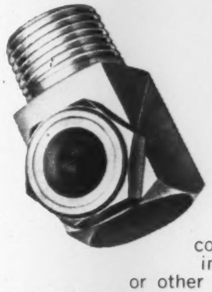


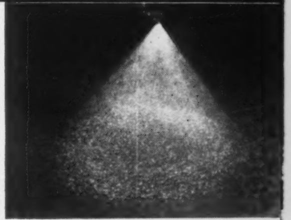


For spraying or washing inside of tubular units or other uses where a circular wide-angle spray is needed. Made in two patterns — 160° hollow-cone spray or 180° flat-circular spray. Available in brass or 303 stainless steel — others on request. Sizes 1/8" — 1/4" — 3/8" male conn.

TAN-JET

SOLID CONE NOZZLES



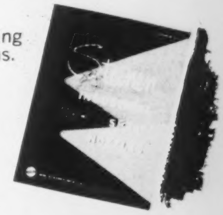


Non-clogging nozzles having a uniform solid-cone spray pattern, furnished in brass, steel, 303 stainless or other suitable materials for any application or process which involves spraying of fluids. Sizes 1/4" — 3/8" — 1/2" male or female conn.

Write for your ***FREE CATALOG TODAY***

FEATURING:

- 32 pages of basic engineering data and nozzle applications.
- New Spray Nozzles for various applications.
- Large selection of spray angles and capacities.
- Simplified, time-saving nozzle selection tables.



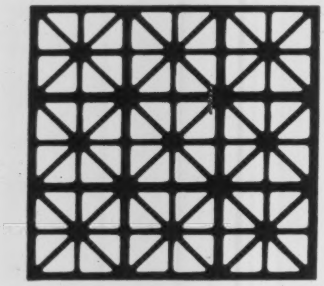
STEINEN

Wm. Steinen Mfg. Co.
INDUSTRIAL NOZZLE DIVISION
39-49 Bruen Street, Newark, New Jersey

SERVING INDUSTRY FOR MORE THAN FIFTY YEARS

THINK OF HENDRICK for ARCHITECTURAL GRILLES

more than 100 designs to choose from

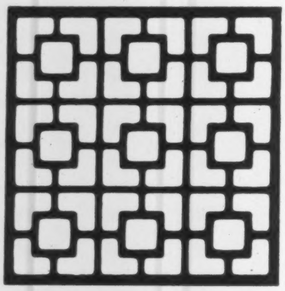


ATTRACTIVE

Hendrick Architectural Grilles combine the functional with the decorative. Many designs are obtainable only from Hendrick.

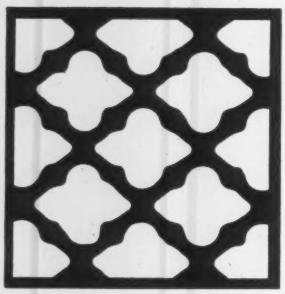
ECONOMICAL

Hendrick Grilles cost less to install and maintain than most architectural materials.



VERSATILE

Each design can be furnished in a wide range of dimensions, with varying numbers and sizes of perforations.



EASY TO INSTALL

Hendrick Grilles always lie flat . . . do not bend or warp. They provide more than enough room for free passage of air.

Write today for more information about Hendrick Grilles.

Hendrick
Manufacturing Company
48 Dundaff Street, Carbondale, Pa.

Perforated Metal • Perforated Metal Screens • Wedge-Slot Screens • Hendrick Wedge Wire Screens • Architectural Grilles • Micro Open Steel Flooring—Shur-Site Treads • Armorgrids • Hydro Dehazers • Distillation Chemical Column Internals

WE HEAR THAT

Continued

▶ The blower division of *ALADDIN HEATING CORP.* is adding another 20,000 sq ft to their present facilities at San Leandro, Calif. This addition brings the total floor space to approximately 120,000 sq ft.

▶ The business, equipment and one plant of *GENERAL ELECTRIC CO.*'s plastics department has been purchased by *HAVEG INDUSTRIES, INC.* The sale which includes the plant in Taunton, Mass., is conditional on the purchasing company's success in negotiating an acceptable agreement with the union representing the plant's employees. Also included in the sales is the business and much of the equipment of the of the company's Decatur, Ill., plant

▶ *TURNER CORP.* is the new corporate name adopted by *TURNER BRASS WORKS.* The reason for the change is a product diversification and marketing modernization program which makes the original name obsolete.

▶ The purchase of *AIR-CON DIV.* of *ALLSTADT MFG. CO.* has been announced by *FRIGIKAR CORP.* The purchasing company will manufacture three models of Air-Con machines, in addition to its regular line.

▶ Two new power gas burners providing input capacity to 1 million Btu per hr and a completely integrated oil burner were introduced recently at a 3 day sales conference held by *NU-WAY CORP.* and *SUNSTRAND ENGINEERING CO.* at Davenport, Iowa.

▶ *ARKLA AIR CONDITIONING CORP.* will make available its "All Year" gas air conditioning units for use by engineering colleges and universities at reduced cost for instructional purposes.

▶ *RECOLD CORP.* has been featured as the subject for one of "The American Success Series" books. "The Recold Story" is a 50 page, illustrated, bound book covering the 27 year history of the west coast firm.

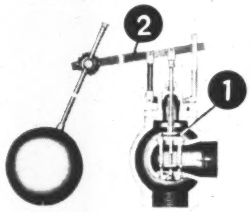
▶ *BEN F. HOMAN* has joined the executive staff of *HOFFMAN, YORK, PAULSON & GERLACH*, a Milwaukee advertising agency.

▶ The name of *AMERICAN METAL HOSE DIV.* of *AMERICAN BRASS CO.* has been changed to *ANACONDA METAL HOSE DIV.* The change has been made to achieve a closer tie-in with Anaconda trademarked products made by the parent company.

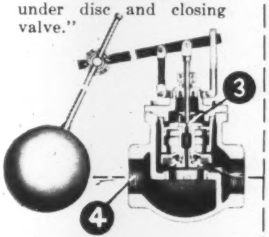
"Which type float valve do you need?"

Here are some basic facts —taken from the Klipfel catalog*—which will help you decide.

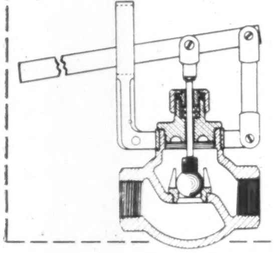
"To control liquid level in an open tank where tight closing is not essential, select a simple, direct acting, balanced float valve such as this Klipfel No. 27. Inner valve (1) opens as float drops. By reversing the lever (2), valve closes as float drops."



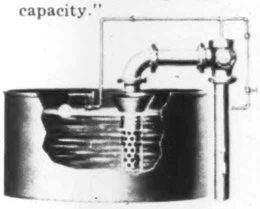
"Single seated float valves close tightly, prevent damage or waste from overflow due to valve leakage. Internal pilot action adds pressure of incoming liquid to buoyance of the float, keeping valve tightly closed. When pilot port (3) opens, water escapes through outlet (4). When it closes, pressure builds up above piston, equalling inlet pressure under disc and closing valve."



"This single-seated, all-metal float valve is ideal for tight closing with fluids injurious to rubber parts. Available in stainless steel or other corrosion-resistant materials to control levels of chemicals, fruit juices, etc."



"External-pilot-operated float valves use a small float valve in the tank to actuate a large main valve conveniently positioned outside the tank. This simplifies maintenance without reducing tank capacity."



***Much useful information on float valves and level control valves is available free in Klipfel Bulletin 254. Write on your company letterhead or ask for the complete catalog on all types of Klipfel automatic regulating valves.**

HAMILTON • OHIO Klipfel **VALVES INC.**

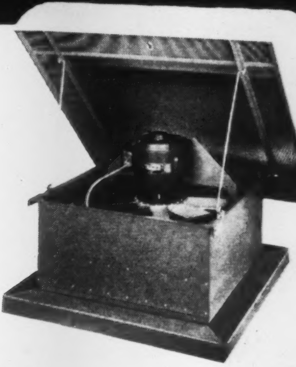
Automatic Temperature-and-Pressure-Regulating Valves Since 1902

Float Valves • Temperature Regulators • Back Pressure Valves • Reducing Valves

A DIVISION OF THE HAMILTON-THOMAS CORPORATION

Reed®

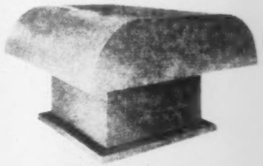
INDUSTRIAL FANS
TOP QUALITY PERFORMANCE



POWER ROOF VENTILATORS

MUSHROOM TYPE DIRECT AND BELT DRIVE

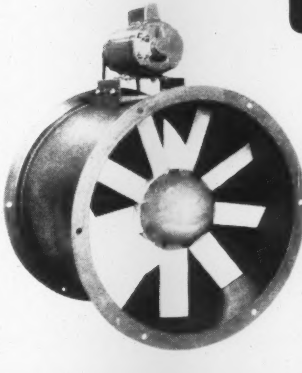
Blade diameters from 12 in. to 60 in. • Static Pressures up to one inch water gauge • Air capacities to 50,000 CFM • Fan section insulated from housing • Ball bearings throughout • Hood can be raised from either end • Truly reversible air flow with equal performance in either direction also available.



new low silhouette

All Reed products are top quality, heavily constructed and built for a lifetime of heavy duty. No riveting is used, but electro - weld and interlocking seam construction throughout.

TUBEAXIAL FANS



DIRECT DRIVE AND BELT DRIVE

Wide range of air deliveries up to 76,000 CFM and static pressures to 6 inch W.G., tailor-made to your air moving problems. 9 to 60 inch diameters, 2 to 13 blades, heavy all-welded construction. Special finishes available.

REED UNIT-FANS, INC.

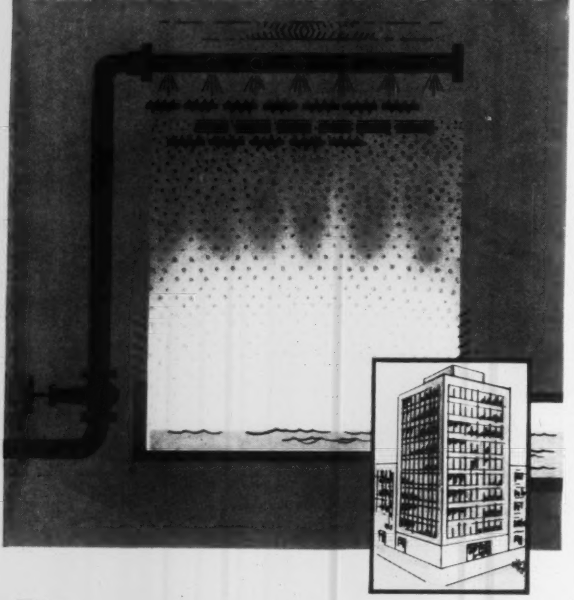
501 North St. Patrick Street • New Orleans 19, La.

25 Years of Quality Fan Construction

Member Air Moving and Conditioning Assn. Inc. (AMCA)

Oakite Airefiner No. 52 in water

GIVES YOU TROUBLE-FREE AIR CONDITIONING—3 WAYS

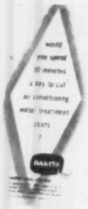


Properly treated water in air conditioning systems goes a long way in prolonging equipment life, improving operating efficiency and keeping systems trouble-free. A small amount of Oakite Airefiner No. 52 added to cooling tower water does all this—and more! A softening and purifying material, Airefiner No. 52:

1. **Checks growth of pipe-blocking, jet-clogging algae and slime**
2. **Prevents build-up of insulating scale**
3. **Minimizes metal-eating corrosion**

Try Oakite Airefiner No. 52 in your water system and see the difference in lower maintenance costs, more efficient cooling, less out-of-service time.

THIS MAINTENANCE MANUAL gives complete details on cleaning and maintaining air conditioning and refrigeration systems at less cost. For your free copy, write Oakite Products, Inc., 51B Rector Street, New York 6, N. Y.



SPECIALIZED INDUSTRIAL CLEANING
OAKITE®
MATERIALS · METHODS · SERVICE
SCIENCE

In our 50th year

Export Division Cable Address: Oakite
Technical Service Representatives in Principal Cities of U. S. and Canada

WE HEAR THAT

Continued

▶ *CAMDALE CORP.*, which owns oil properties in Texas and Kentucky, has moved into the plastics field. The corporation has created an additional division by purchasing controlling interest in *COMMERCIAL FIBREGLAS PRODUCTS, INC.* of Houston. The firm has also transferred its home office to Houston at 828 Niels Esperson Bldg.

▶ Twenty-one service representatives of five airlines soon to fly the Douglas DC-8 Jetliner, attended a week-long training session given by *CARRIER CORP.* They were briefed on operation, testing procedures and maintenance of the vapor cycle air conditioners, two of which will provide each of the aircraft with nearly 30 tons cooling capacity.

▶ Exclusive national and foreign sales rights for land installations of the products of *DAYTON AUTOMATIC STOKER CO.* have been awarded to *WILL-BURT CO.*

▶ *BETTCHER MFG. CO.* announced the purchase of *THERMOBLOC DIV.* of *PRAT-DANIEL CORP.* The new division will manufacture and market its products as *PANELBLOC DIV.* of *BETTCHER MFG. CO.*, and will have its headquarters at the purchasing company's main plant.

▶ Stockholders representing more than 90 percent of *METALS & CONTROLS CORP.* voted at a special meeting recently to merge the firm into *TEXAS INSTRUMENTS, INC.* of Dallas. Stockholders of the Texas firm will vote on the merger at their annual meeting.

▶ *WALWORTH CO.* recently completed negotiations with *MIDWEST PIPING CO., INC.* for the manufacture of the company's welding fittings. The line will be sold nationally through *WALWORTH CO.* offices and distributors.

▶ *PAUL W. FLETCHER* has joined the Providence, R. I., firm formerly known as *KIELY JR. & ASSOCIATES* as a partner. The firm of consulting engineers is now known as *KIELY FLETCHER AND ASSOCIATES.*

▶ At a recent two-day national sales meeting, *EMBASSY STEEL PRODUCTS* announced that it will begin the manufacture of electric baseboard.

▶ *OLD DOMINION IRON & STEEL CORP.* now X-rays all storage tanks and pressure vessels before they leave the corporation's plant. Welded seams are inspected for defects as an added precaution to provide quality assurance. ⌗

MODERNIZING?

Check **FRICK** Refrigeration

FOR ALL YOUR NEEDS

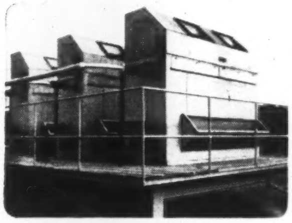
- ☑ CONDENSERS
- ☑ PIPE COILS
- ☑ SHELL-ICE MAKERS
- ☑ VALVES & FITTINGS
- ☑ ICE RESERVE UNITS
- ☑ AIR HANDLING UNITS
- ☑ SHELL & TUBE COOLERS
- ☑ "ECLIPSE" COMPRESSORS
- ☑ HEAVY-DUTY COMPRESSORS
- ☑ QUICK-FREEZING SYSTEMS
- ☑ "INSTANT" WATER COOLERS
- ☑ MULTI-STAGE COMPRESSOR SYSTEMS
- ☑ LOW PRESSURE REFRIGERATION UNITS
- ☑ AUTOMATIC CONTROLS & DEFROSTING SYSTEMS
- ☑ ☑ COMPLETELY ENGINEERED SYSTEMS, DELIVERED AND INSTALLED

It is a proven fact that today's semi- and full-automatic equipment soon saves enough to pay for itself.

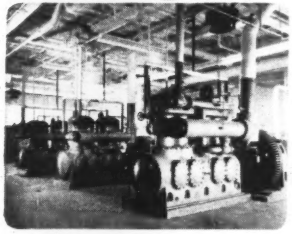
Whatever the refrigeration requirements of your plant—quick freezing, ice making, cold storage, humidity control, low temperatures, condensing, air conditioning, or any process cooling . . . Frick engineers will help you modernize your present system or design one to meet your needs.

Frick refrigeration equipment is world renowned for a long trouble-free life of dependable operation. Many Frick compressors have been in operation for over 40 years.

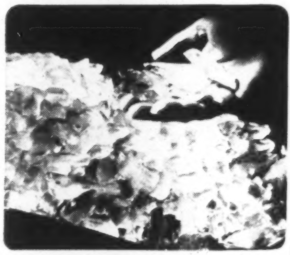
***CALL** your nearest Frick Branch or Distributor today. Or write direct to . . .*



Frick Evaporative Condensers Save Up to 95% of the Water Used.



Frick Heavy-Duty Four Cylinder Compressors Can Be Adapted to Handle Any Type of Refrigerant.



Frick Shell-Ice—Clear Solid Pieces of Curved Ice. Made Automatically, Without Snow or Waste.

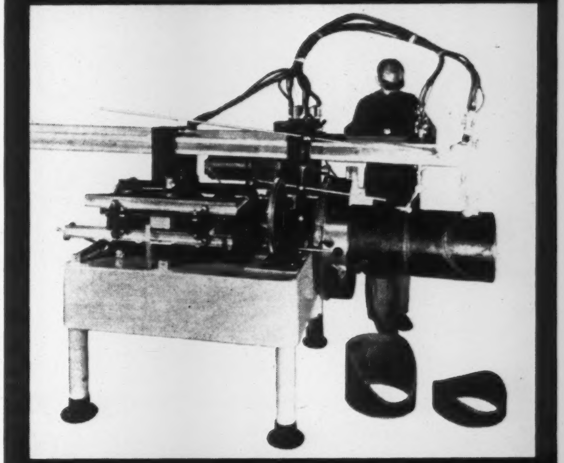
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

WAYNESBORO, PENNA., U.S.A.

NOW CONTOUR PIPE WITHOUT CAMS OR TEMPLATES

..with "THE MECHANICAL DRAFTSMAN"



Model 424 shown making 30° contour cut and straight cut-off simultaneously on 16" pipe.

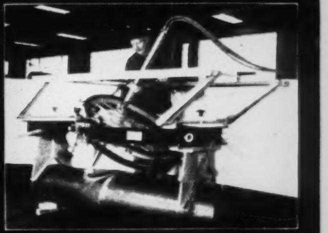
Available in 3 models for various pipe sizes.

May be equipped with Heliare for cutting of Aluminum, Stainless, Copper, etc.

"The MECHANICAL DRAFTSMAN" makes accurate, slag-free cuts *. . . ready for welding . . . automatically.*

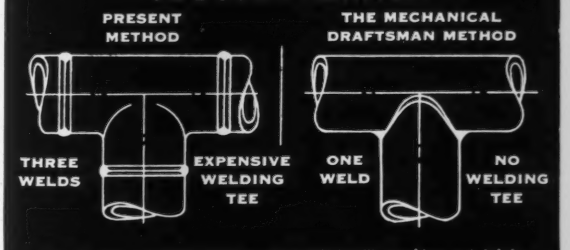
"THE MECHANICAL HOLE CUTTER"

Cuts a perfect hole to match the contoured end cut made by The MECHANICAL DRAFTSMAN. Will cut circles and ellipses in flat plate, as well as perpendicular or angular holes in pipe and tank shells. Available in 3 Models to cut holes to 24" diameter.



Model 024-Mechanical Hole Cutter

PIPE JOINT METHODS



Specify "The MECHANICAL DRAFTSMAN" machine cut joints. Elimination of welding fittings and reduction in cutting, fitting and welding time in piping installations results in material and labor savings as high as 75%.

STEFFAN MANUFACTURING CORP.
SALEM, OHIO

MEETINGS & CONVENTIONS

1959

JUNE 1-4—National District Heating Association, 50th golden anniversary meeting, Skytop Club, Skytop, Pa. Information: John F. Collins, Jr., 827 N. Euclid Ave., Pittsburgh 6.

JUNE 1-5—AGA Gas Air Conditioning Sales School, Baker Hotel, Dallas. Information: Arthur Q. Smith, Public Information Bureau, American Gas Association, 420 Lexington Ave., New York 17.

JUNE 1-5—National Fire Protection Association, annual meeting, Atlantic City, N. J. National Fire Protection Association, 60 Batterymarch St., Boston 10.

JUNE 1-5—Fifth World Petroleum Congress Exposition, New York Coliseum. Information: E. K. Stevens, Exposition Manager, International Exposition Co., 480 Lexington Ave., New York 17.

JUNE 4-5—Engineering Institute for Consulting Engineers, University of Wisconsin, Madison, Wis. Information: Robert L. Loetscher, Institute Coordinator, University of Wisconsin, Extension Div., Dept. of Engineering, Madison 6, Wis.

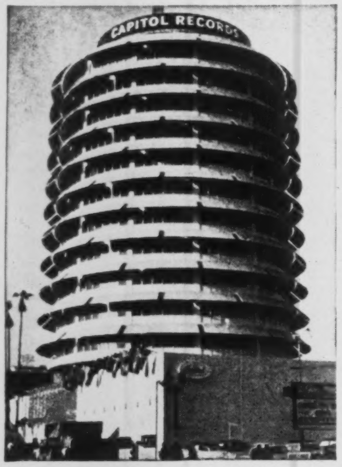
JUNE 14-19—Electrical Precipitation Seminar, Pennsylvania State University. Information: Extension Conference Center, The Pennsylvania State University, University Park, Pa.

JUNE 21-26—American Society for Testing Materials, annual meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. American Society for Testing Materials, 1916 Race St., Philadelphia 3.

JUNE 22-24—American Society of Heating, Refrigerating and Air-Conditioning Engineers, annual meeting, Lake Placid Club, Lake Placid, N. Y., American Society of Heating, Refrigerating and Air-Conditioning Engineers, 62 Worth St., New York 13.

JUNE 22-26—Air Pollution Control Association, annual meeting, with technical sessions and exhibits, Hotel Statler, Los Angeles. Air Pollution Control Association, 4400 Fifth Ave., Pittsburgh 13.

JUNE 22-26—Short Course in Corrosion Reactions and Corrosion Control, Massachusetts Institute of



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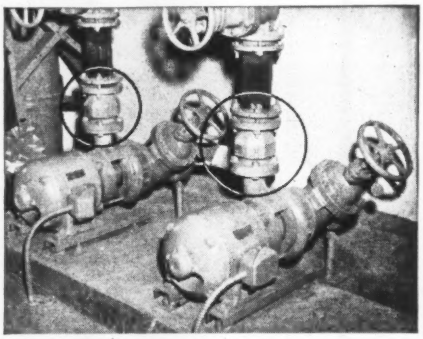

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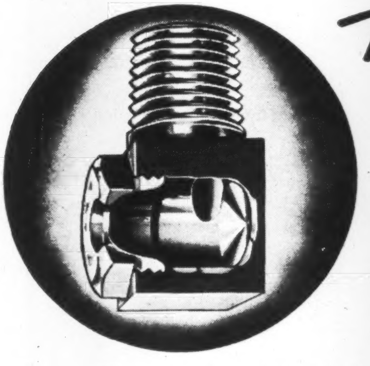

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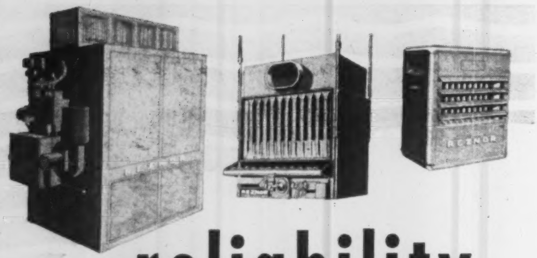

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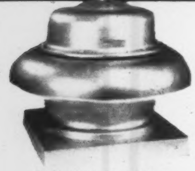

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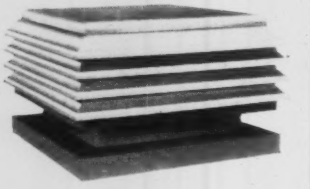

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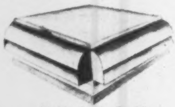

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MEETINGS & CONVENTIONS

Continued

1959

Technology, Cambridge, Mass. Presented in cooperation with the National Association of Corrosion Engineers. Information: James M. Austin, Director of Summer Session, Massachusetts Institute of Technology, Cambridge 39, Mass.

SEPT. 21-25—*Instrument Society of America*, instrument-automation conference and exhibit. International Amphitheater, Chicago. For information contact: Fred J. Tabery, exhibit manager, Instrument-Automation Conference and Exhibit, 3443 S. Hill St., Los Angeles 7.

SEPT. 28-*OCT.* 1 —*American Welding Society*, fall meeting. Sheraton-Cadillac Hotel, Detroit. American Welding Society, 33 W. 39th St., New York 18.

OCT. 5-7—*American Gas Association*, annual convention. Conrad Hilton Hotel, Chicago. American Gas Association, 420 Lexington Ave., New York 17.

NOV. 2-5—*Air Conditioning and Refrigeration Institute*, 11th exposition. Atlantic City Auditorium, Atlantic City, N. J. Air-Conditioning and Refrigeration Institute, 1346 Connecticut Ave., N. W., Washington 6, D. C.

1960

FEB. 1-4—*2nd Southwest Heating and Air Conditioning Exposition*. Memorial Auditorium, Dallas. Under auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers, in conjunction with the newly merged society's semi-annual meeting, also in Dallas. For information contact: International Exposition Co., 480 Lexington Ave., New York 17. ASHRAE headquarters: 62 Worth St., New York. +

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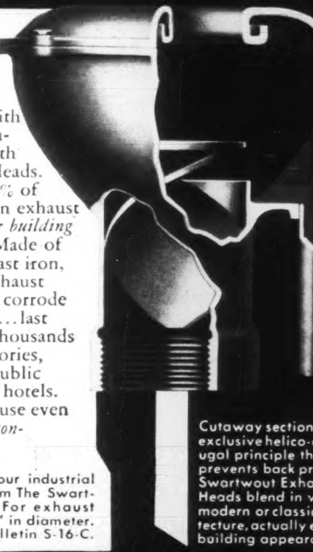

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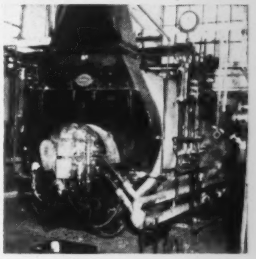

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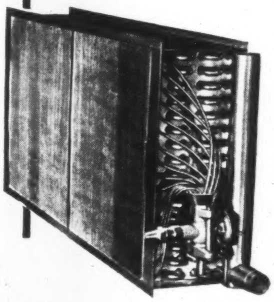

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THE HEATING VENTILATING AIR CONDITIONING GUIDE 1959, 37th edition. American Society of Heating Refrigerating and Air-Conditioning Engineers, 62 Worth St., New York 13. $12.00.

OFFICIAL PROCEEDINGS OF THE 49TH ANNUAL MEETING OF THE NATIONAL DISTRICT HEATING ASSOCIATION. 177 pp. National District Heating Association. 827 N. Euclid Ave., Pittsburgh 6. $7.50.

NATIONAL FIRE PROTECTION ASSOCIATION INSPECTION MANUAL, second edition—Edited by Horatio Bond. 320 pages. National Fire Protection Association. 60 Batterymarch St., Boston 10. $4.00.

1959 ATOMIC INDUSTRY DIRECTORY OF PRODUCTS, EQUIPMENT AND SERVICES. Atomic Industrial Forum, 3 E. 54th St., New York 22.

ORDINATES FOR 500 PIPE INTERSECTIONS—By Sid D. Bowman. Claitor Publishing Co., 241 North St., Baton Rouge 2, La. $2.00.

MODERN METHODS OF PIPE FABRICATION—By S. D. Bowman. 91 pp. Claitor Publishing Co., 241 North St., Baton Rouge 2, La. $2.00.

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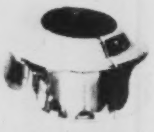
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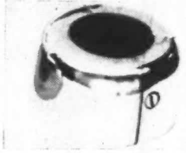
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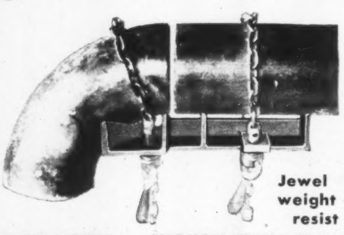

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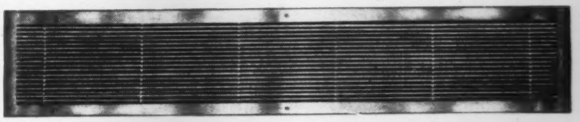

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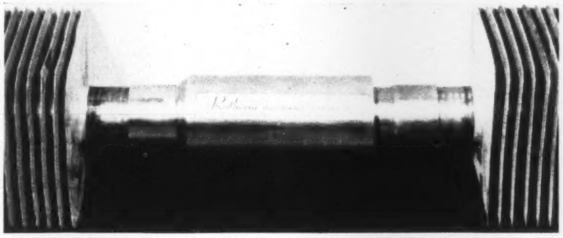

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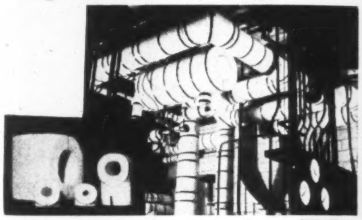

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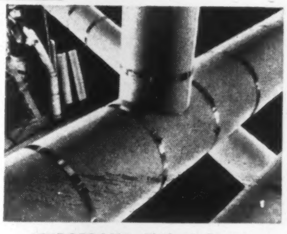

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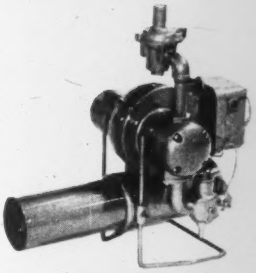

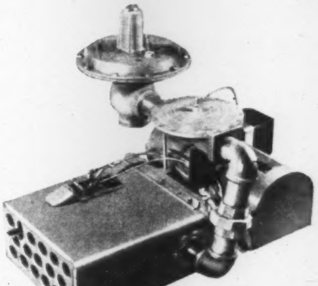

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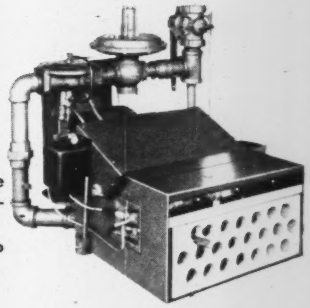

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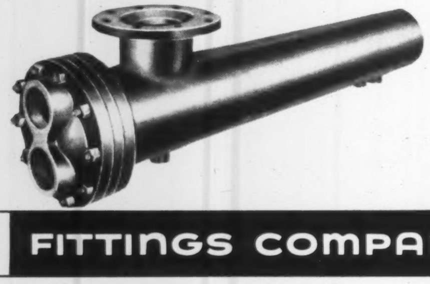

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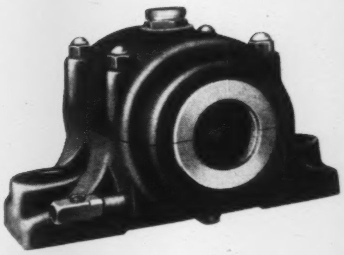

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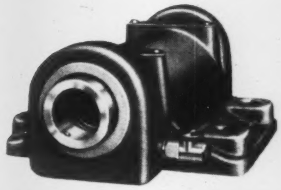

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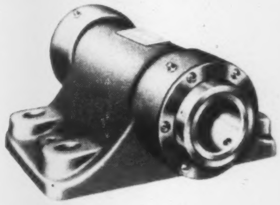

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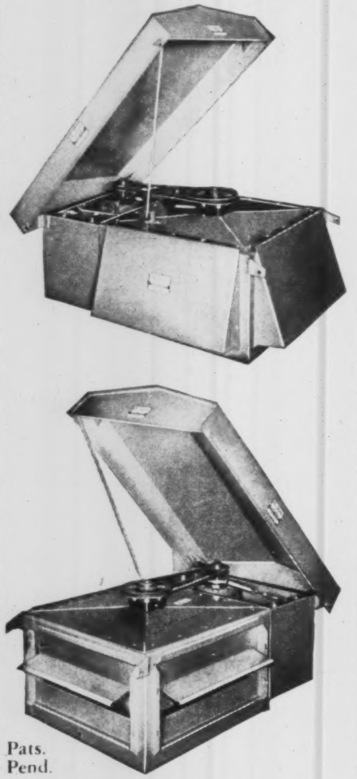

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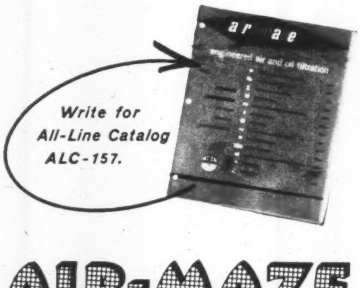
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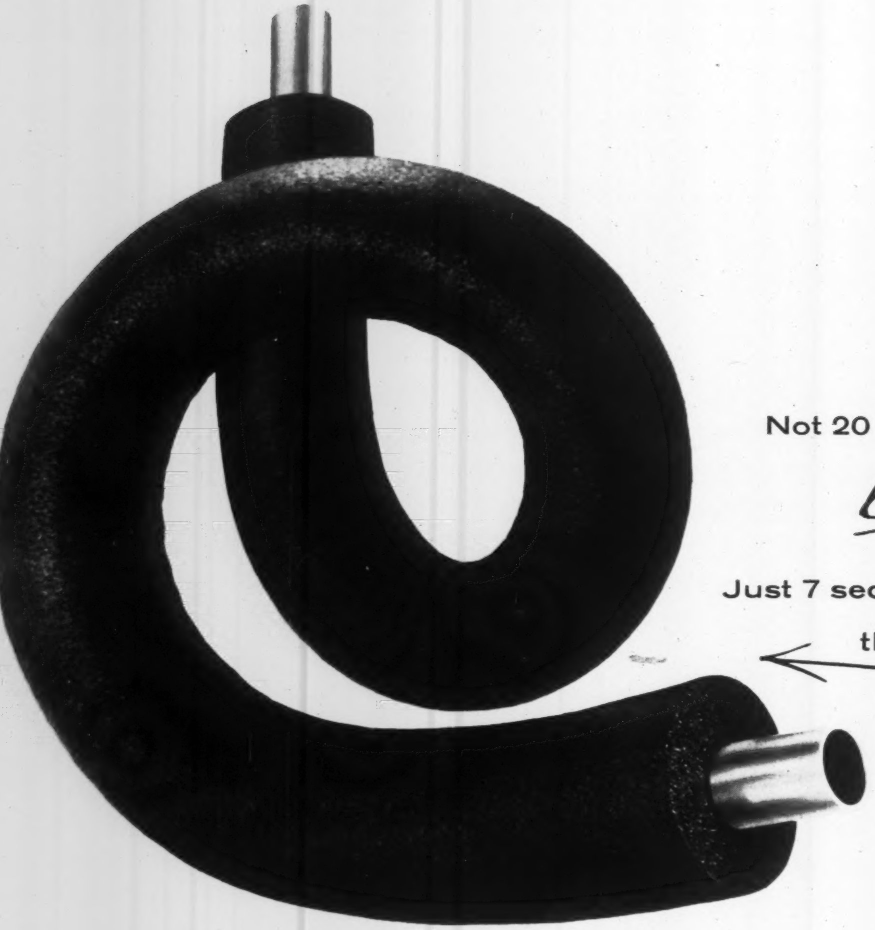


Not 20 to 30 minutes—

but

Just 7 seconds to insulate this bend!

New Johns-Manville AEROTUBE insulation cuts labor costs 50%... and more!

New Aerotube® Insulation entirely eliminates twine wrapping, skirting and other time-consuming methods of insulating lines that sweat!

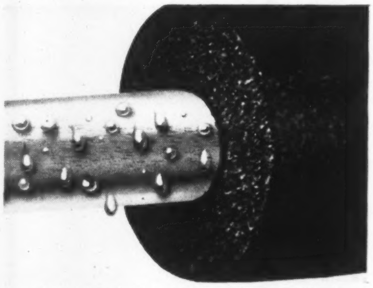
On a straight run of pipe or the most complex bend—Aerotube goes on fast! Just slides on new lines . . . six feet at a time . . . in a matter of seconds! On connected pipe, the job takes but little longer. Just the time it takes to slit Aerotube longitudinally, snap on pipe, and cement.

With all its savings in time, Aerotube gives you better results! Its unique closed-cell structure helps seal against heat transfer . . . gives Aerotube a built-in vapor barrier that retains its integrity indefinitely.

Use Aerotube wherever an effective vapor-sealed insulation is needed—air conditioning run-outs, CO_2 lines, dual temperature systems, on any line (to 200F) where Aerotube's labor savings will repay its slight additional cost many times over!

Send for informative new AEROTUBE brochure, IN-213A. It illustrates methods of fitting AEROTUBE to all types of fittings . . . sweat and screw type joints . . . and connected pipe. Gives best thicknesses for various design conditions, with helpful facts on sizes, packaging data and dimensions. *Write for your free copy now!* Address Johns-Manville, Box 14, N.Y. 16, N.Y. In Canada, Port Credit, Ont.

Flexible new foamed plastic insulation



Aerotube insulation is its own vapor barrier.

JOHNS-MANVILLE

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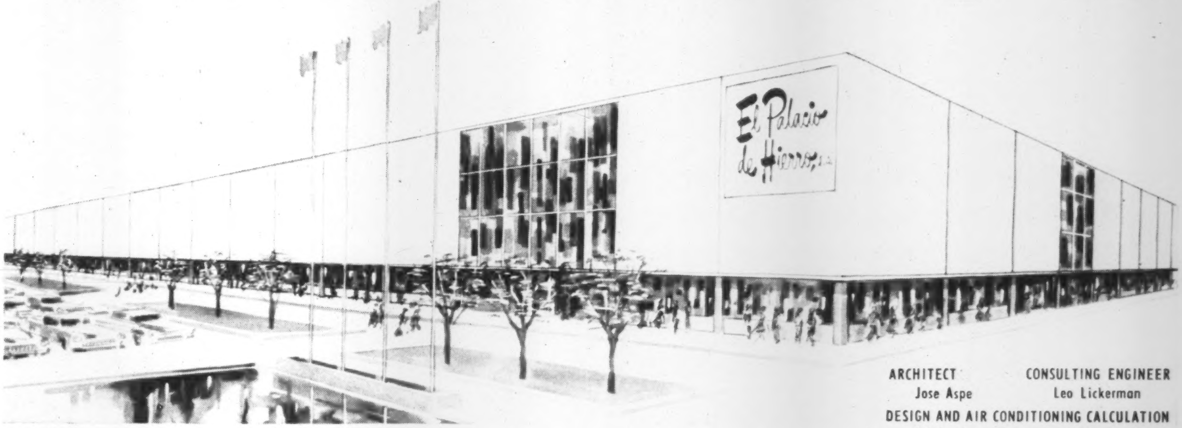
CLARAGE



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Calefaccion y Ventilacion, S.A.

CONTRACTOR
Calefaccion y Ventilacion, S.A.

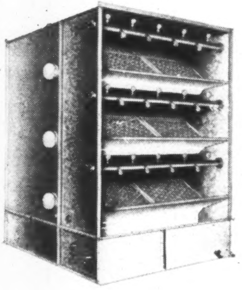
Forward striding Mexico...

another land where Clarage gives air a lift

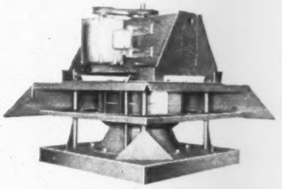
World-wide, Clarage quality is known and called upon. Down Mexico City way, for example, is the new Palacio de Hierro.

Here, in this city's largest and most modern department store, Clarage air handling and conditioning equipment is at work — Capillary Air Washers and Centrilator Power Roof Ventilators. Why is Clarage so often selected for buildings of all types, all sizes? Largely because of this equipment's reputation for faithful performance and operating economy.

Contact our nearest sales engineering office. You too will find it's characteristic of Clarage products to prove out successfully no matter how challenging the requirements.



REQUEST CATALOG 405 covering the Clarage Capillary Air Washer. Equipped with capillary cells. Three arrangements available. Capacities 4,400 to 132,000 CFM.



REQUEST BULLETIN 550 covering the Clarage Centrilator Power Roof Ventilator. Static pressures to 2"; capacities to 26,400 CFM. (Unit shown here without cover.)

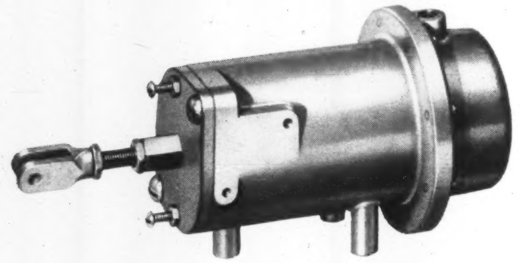
Dependable equipment for making air your servant

Kalamazoo, Michigan

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

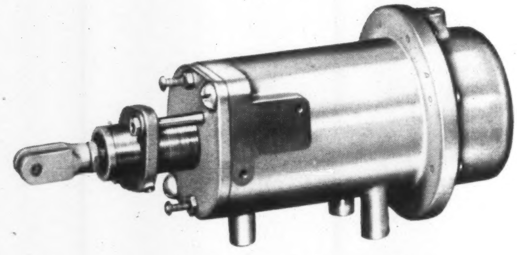
JOHNSON PISTON-TYPE DAMPER OPERATORS

ASSURE MAXIMUM POWER FOR ACCURATE CONTROL OF DAMPERS



D-251 Piston Damper Operator

- Powerful, long-stroke design. Allows damper to be operated *directly* from piston rod for accurate, positive positioning. No linkage or levers to lessen power. Outperforms conventional operators.
- Simple, trouble-free construction. Spring and diaphragm are fully enclosed. Powered by molded rubber diaphragms which are age- and heat-resistant.
- Adjustable stops permit limiting stroke in either direction.
- May be mounted in any position on damper frame, wall, or duct.
- Attractive die-cast, non-corrosive body.
- Size Nos. 2, 3, 4, and 6.

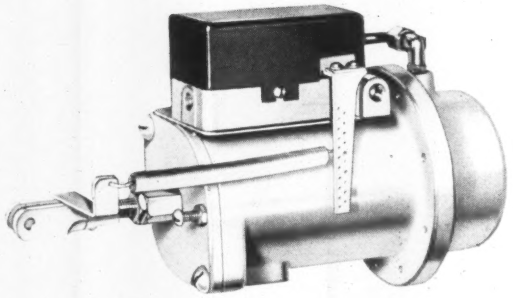


D-255 Two-Stage Piston Operator

Designed especially for unit ventilator applications, the D-255 two-stage operator has the same general features as D-251 plus:

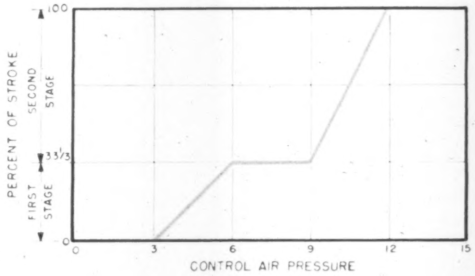
- Two-stage operation (see chart below). First stage is adjustable 0 to 50 per cent of total stroke.
- Compact, fits all unit ventilators. No. 3 size only.
- Choice of molded rubber or molded silicone diaphragms. Heat- and age-resistant.
- Self-lubricating Nylon insert stem guide.

For full details on the Johnson equipment shown here, write for Bulletins D-251, D-255 and D-265. Johnson Service Company, Milwaukee 1, Wisconsin.



D-265 Pilot Positioner Applied to D-251 Piston Damper Operator

The D-265 Pilot Positioner provides maximum and accurate repositioning power in response to very small changes in pressure from the controlling instrument. Assures proper operation independent of friction, changes in air velocities, or other variables. May be applied to all sizes of D-251 operators.



Relationship between stroke and control air pressure of D-255 Two-Stage Piston Operator.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885